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THE ELDER PLINY'S CHAPTERS
ON
CHEMICAL SUBJECTS

Part. I.

THE ELDER PLINY'S CHAPTERS

ON

CHEMICAL SUBJECTS

PART I.,

EDITED, WITH TRANSLATION AND NOTES,

BY

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PREFACE

A new edition of a classical work requires, perhaps, some apology. No English edition of any part of the Natural History of Pliny with translation and notes is available, with the single exception of " The Elder Pliny's Chapters on the History of Art ", by Jex-Blake and Sellers, covering portions of Books XXXIII-XXXVI. The most modern translation of the whole of the Natural History is that of Bostock and Riley, published in 1855. In the very considerable interval which has elapsed, the advance of chemistry has been extremely rapid, and the student of the history of chemistry has at his disposal weapons so much more powerful as to warrant a new translation.

Though the chemical knowledge of the Romans receives fair consideration in some of the recently-published histories of chemistry, this is not usually the case. At least one such volume completely ignores Roman chemistry, and even those which give a fairly complete account of the more obvious facts, do not attempt to elucidate the many points of difficulty. This is, indeed, hardly possible for a writer who aims at covering the whole history of chemistry, and can only be essayed by one who concentrates on a more narrow field.

In preparing an edition of " The Elder Pliny's Chapters on Chemical Subjects ", I have made it my object to attempt a solution of every difficulty, and, where these have proved insoluble, I have thought it better to admit failure than to pass the problem by in silence.

It has not always been easy to determine which passages should be included in a work of this description. I have been guided by the following principles. It seems clear that Pliny's Natural History can only be edited at the present day in an adequate manner by those who have a competent knowledge of the branches of science involved. This means that a complete edition must be made in sections, of which "The Elder Pliny's Chapters on the History of Art" by Jex-Blake and Sellers may be regarded as the first, and the present work (to be completed in two volumes) constitutes the second. The chapters on Botany, Zoology, Medicine, and other subjects must receive treatment from those who are expert in those sciences.

When, therefore, it was necessary to take sections from the earlier books of the Natural History, books which consist mainly of non-chemical matter, only those sections which are directly concerned with chemical subjects were selected.

On the other hand, the whole of Book XXXIII (except a few paragraphs already edited by Jex-Blake and Sellers) has been included, even parts which have little connection with chemistry, for only thus can the whole of the Natural History be covered by such a scheme as I have outlined above.

No work on the manuscripts of Pliny has been attempted. Indeed, such work could hardly hope to add much to the imposing lists of variants included in the editions of Sillig and Mayhoff. I have not, however, been content to adopt the text of any single earlier editor and, in every case where doubt seemed reasonable, the probabilities have been carefully weighed before a reading was adopted. Conjectures have been made as sparingly as possible, but have seemed occasionally necessary. The critical notes deal only with passages where the reading is genuinely doubtful.

It is hoped that this work may fulfil a double purpose, providing for students of the classics an up-to-date edition of part of the writings of a great Roman and a great man, and at the same time furnishing those who are interested in the history of chemistry with information which is vital to their subject.

I have endeavoured, in my notes, to mention those who have made substantial contributions to the elucidation of a particular point, but I have not thought it necessary (even if it were possible) to discover in every case the first to make an obvious comment or cite an easily-discovered parallel.

The arrangement into sections and paragraphs adopted by Sillig has been followed, with insignificant exceptions.

Every effort has been made to prepare an Index as full and as accurate as possible, though it is too much to hope that it will be found completely free from error. Sillig's Index has been found useful in checking, but many references are included which were omitted, or incorrectly given, by Sillig.

It is impossible to acknowledge fully the extent of my obligations to living scholars. There are few of my colleagues on either the scientific or the classical side to whom I am not indebted for some measure of assistance, and I desire to express my gratitude to all who have helped me in any way. It is, however, a pleasure to offer my especial thanks to Dr. L. C. Purser, formerly Vice-Provost of Trinity College, who has put ungrudgingly at my service his immense store of classical erudition; to Dr. E. A. Werner, Professor of Chemistry in the University of Dublin, whose wide knowledge of chemistry has shed light on many a dark corner; to Dr. E. H. Alton, F. T. C. D., Professor of Latin in the University of Dublin, whose encouragement and help in the early stages of the work were invaluable; to Dr. J. G. Smyly, S. F. T. C. D., Librarian of Trinity College, Dublin; to my wife, Dr. Dorothy Bailey, to whose critical judgment every part of this edition is deeply indebted, and to the Board of Trinity College, Dublin, for a grant from the Madden Fund towards the expenses of this work.

K. C. B.

Trinity College,
Dublin,
February, 1929.

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INTRODUCTION

Pliny — Man and Writer

" I remember once, his reader (at dinner-time) having pronounced a word wrong, somebody at the table made him repeat it again, upon which my uncle asked his friend if he understood it? Who acknowledging that he did, ' why then, ' said he, ' would you make him go back again? We have lost by this interruption of yours above ten lines ' " (1) — a truly illuminating story !

Caius Plinius Secundus was born (at Novum Comum, according to Suetonius, at Verona, according to an anonymous biographer) in 23 A. D.. He perished in the eruption of Vesuvius in 79 A. D., after a life which, if its true length be measured by its active hours (a view to which he himself inclined), (2) was longer than most.

In this arduous life, he achieved a blend of public service and literary work which is probably unparalleled. To quote again from his nephew and adopted son, Pliny the Younger — " When you reflect upon the books he has read, and the volumes he has written, are you not inclined to suppose that he never was an official or a courtier? On the other hand, when you are informed how painstaking he was in his studies, are you not disposed to think that he read and wrote too little? " (1) His public offices ranged from the Augurship of his youth to the position as Admiral of the Fleet which he held at the time of his death : his literary production included, in addition to the thirty-seven lengthy books of his ' Natural History ', a treatise on the ' Art of Using a Javelin on Horseback', a ' Life of Pomponius Secundus ' in two volumes, a ' History of the German Wars ' in twenty books, ' The Students ' in six volumes, ' Linguistic Queries ' in eight books, a continuation of the History of Aufidius Bassus, and a hundred and sixty rolls of miscellaneous observations (3).

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(1) Pliny the Younger — Ep. 3, 5, —Melmoth's translation, Loeb Library.

(2) *'vel hoc solo praemio contenti, quod dum ista (ut ait M. Varro) musinamur, pluribus horis vivimus. Profecto enim vita vigilia est'.* —H. N. Prooemium.

A vivid picture of his uncle is given by the Younger Pliny (4), who felt for him a respect and affection such as nephews do not commonly show for their uncles. In his Letters we see our author as a portly, somewhat pompous old gentleman, the friend and adviser of the Emperor Vespasian, full of the cares of office, but never too busy to find time for the pursuit of knowledge.

He began his studies at midnight in summer, an hour or two later in winter; he either read or was read to while resting, while eating, and while moving about Rome, which he always did in a chair, that he might not waste precious moments in exercise; he did not fail to superintend the education of his nephew, whose almost unnatural zeal for his books saved him from sharing his uncle's death.

We can, moreover, fill in the details of this picture, not only from the Prooemium to the Natural History, a dedication to the Emperor Vespasian which repays perusal, but also by noting the comments on life and on his contemporaries which are scattered through Pliny's *magnum opus*. He felt, or at least affected, a great contempt for those to whom riches were the goal of life, and indeed we find no trace of hunger for gold in his own story, for we know that, on at least one occasion, he refused an offer of four hundred thousand sesterces for his manuscripts. ' Would that gold could be driven utterly out of our lives, ' cries Pliny, (5) 'for, to quote the most famous writers, it is accursed by reason of the hunger with which it is sought, censured and reviled by all really good men, and discovered only to be a scourge to life '. These words are typical of the feelings which Pliny frequently expresses throughout his work.

As a writer, Pliny can hardly be said to deserve the eulogy which Buffon pronouces on him, praising his lofty ideas, his nobility of style, and his delicacy of reflection, as well as his immense knowledge. His style, especially, falls far short of the classical standard and gives one the impression that the work was written in haste, and that little time was spent on revision. The anonymous biographer says justly ‘ *opus... stylo duriusculum* ’. The Prooemium, however, shows that Pliny was capable of more elegant writing, and it has a finish which is seldom to be found in the rest of the Natural History.

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(3) Pliny the Younger — op. cit.
(4) Ep. 3, 5; 6, 16.
(5) H. N. 33, 6.

Pliny is often accused of being a mere collector of facts from other writers, and of failing to test their accuracy by independent investigation. There are few writers of scientific text-books against whom this charge might not justly be made. When the field is wide, one must be dependent on other observers for most of one's information, and who ever had a wider field than Pliny? It is true that he does not always exercise sound judgment in selecting his facts, but we frequently find evidence that his critical faculties are awake, as when he questions Hesiod's stories of longevity (6), disagrees with his authorities about the use of asafoetida as a remedy for toothache (7), is sarcastic concerning superstition (8), and sets limitations to the use of vermilion in medicine (9). There are occasional signs, too, of independent inquiry, and we may be sure that the last great investigation, in which he perished, was not also the first.

We certainly cannot rank Pliny among the great thinkers of the Roman world. He recounts facts, but he seldom attempts a generalisation based on these facts. In reading his account of chemical substances, we are struck by the contrast between the very considerable amount of accurate knowledge about their properties and the almost entire absence of theorising, however elementary. In antiquity, one was interested in either facts or theories, but not, as a rule, in both.

A student used to modern chemical literature will, in the pages of Pliny, find himself far from the rather arid atmosphere in which digressions are forbidden, and pleasant but useless information is omitted. We are not sure that the modern writer has not abandoned a valuable means of holding the attention of the reader. The difficulty of style once conquered, the reader of Pliny seldom suffers from boredom, and his interest is sustained by anecdote and comment. The personality of the writer reaches him in a way that is rare in modern works of science.

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(6) H. N. 7, 153.
(7) H. N. 22, 106.
(8) H. N. 28, 17-21 etc.
(9) H. N. 33, 124.

At times Pliny shows that he possesses a sense of fitness which is unusual in Roman writers. He is conspicuous by his anxiety to acknowledge fully his debt to his predecessors, and he expresses in no measured terms his contempt for those who appropriate the work of earlier writers. (10) Again, he is careful to include, at the beginning of his work, a full list of the subjects dealt with therein, so that ' one may know where to find just what one wants. ' (10).

Pliny is under no illusion as to the uniqueness and difficulty of his task, and he expresses himself without false modesty. ' No Roman, no Greek, has ever essayed the same task, or treated single-handed such an infinity of subjects ' (10), and again, with epigrammatic force, '*Res ardua, vetustis novitatem dare, novis auctoritatem, obsoletis nitorem, obscuris lucem, fastiditis gratiam, dubiis fidem, omnibus vero naturam, et naturæ suæ omnia* ' (10). Twenty thousand facts from two thousand books by one hundred authors he claims to include, ' *adjectis rebus plurimis, quas aut ignoraverant priores, aut postea invenerat vita* ' (10).

No one who has made a study of the life and works of Pliny can fail to feel a certain affection for this man who attempted single-handed, and executed successfully, what few men in the past have envisaged and certainly no man will ever attempt again —an encyclopaedia of science.

Death shows us at our true value, and Pliny's death became him well. His desire to inspect at close quarters the eruption of Vesuvius, that he might make observations of this astonishing phenomenon, led him to order a light vessel to be prepared to bring him nearer to the blazing mountain. At the moment of departure he received an appeal for help from Rectina, whose villa was in danger. ' He changed his first design, and what he began with a philosophical, he pursued with an heroical turn of mind '. When he discovered that retreat was impossible, he did not give way to fear, but, by his cheerful unconcern, encouraged and heartened all who were with him. He was eventually overtaken and smothered by the acrid fumes. His nephew tells us that, when at last the sun could pierce the darkness, ‘ his body was found entire and uninjured, and still fully clothed as in life; its posture was that of a sleeping, rather than a dead man ’ (11).

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(10) H. N. 1, Prooem.

So died Pliny, a bookworm and a pedant, but a lovable pedant and a fearless and honourable gentleman.

List of paragraphs in which conjectures, new in this edition, are included in the text, or suggested in the critical notes.

9, 127; 19, 47; 31, 78, 85, 88, 92, 109,111; 33, 1, 13, 16, 31, 47, 59, 65(3), 68, 115, 119, 121, 126.

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(11) Pliny the Younger —Ep. 6, 16—Melmoth's Translation, Loeb Library.

ABBREVIATIONS USED IN THE CRITICAL NOTES.

MANUSCRIPTS

A	Codex Leidensis.
B	.... Bambergensis.
D	.... Vaticanus 3861.
K	Vetus Codex Dalecampii.
P	Codex Monacensis.
R	Codex Riccardianus.
S	.... Salmanticensis.
T	.... Toletanus.
V	.... Vossianus.
a	.... Parisiensis 6795.
d	.... — 6797.
e	.... — 6798.
h	.... — 6801.
i	.... — 6802.
l	.... — 6803.
p	.... Petropolitanus.
r	Man. Dalecampii.
Θ	Codex Chiffletianus.
ω	.... Vindobonensis.
Mss.	All manuscripts.
Al.	Manuscripts other than those mentioned.

(B is much superior to the other manuscripts. K and r do not now exist, and are represented by notes in the edition of Dalechamps. Sillig is of opinion that r represents genuine manuscript readings, but that many of the readings denoted by K are conjectures. Further information about the manuscripts should be sought in the critical editions of Sillig and Mayhoff.)

EDITORS, EDITIONS, ETC.

Barb. — Hermolaus Barbarus (Castigationes Plinianæ, 1492).

Bergk — Th. Bergk (Exercitationes Plinianæ, 1847, 1851).

Brot. — Brotier (1779).

Dal. — Dalechamps (1587).

Detl. — Detlefsen (1873).

Desaint Ed. — Ed. L. Poinsinet de Sivry (Paris, 1778).

Gelen. — Gelenius (1554).

Gron. — Gronovius (notæ 1669. Vol. VI, Sillig's edition).

H.N. — *Historia Naturalis* of Pliny.

Hard. — Hardouin (1685).

Jan — Ludwig von Jan (1860).

May. — Mayhoff (1875-1897).

Müller — C. W. F. Müller (Krit. Bemerkgn. zu Plinius' Nat. Hist., Breslau, 1888).

Pint. — Pintianus (1544).

Salmas. — Salmasius (Plinianæ exercitationes in Solini polyhistora, 1629).

Sill. — Sillig (1851).

Url. — Urlichs (Chrestomathia Pliniana, 1857).

W. — Brotier and Dalechamps.

Ed. — This edition.

Conj. Ed. — Conjectures by the editor.

Ed. (conj. L. C. P.) — Conjectures by Dr. L. C. Purser, included for the first time in this edition.

Ed. (conj. E. H. A.) — Conjecture by Dr. E. H. Alton, included for the first time in this edition.

TEXT

and

TRANSLATION

C. PLINII SECUNDI NATURALIS HISTORIÆ

LIBER II.

Cap. CIV. Sect. 108. **235.** In urbe Commagenes Samosata stagnum est emittens limum (maltham vocant) flagrantem. Cum quid attigit solidi, adhæret; præterea tactu exsequitur fugientes. Sic defendere muros oppugnante Lucullo; flagrabat miles armis suis. Aquis accenditur. Terra tantum restingui docuere experimenta.

Cap. CV. Sect. 109. Similis est natura naphthæ; ita appellatur circa Babyloniam et in Astacenis Parthiæ profluens bituminis liquidi modo. Huic magna cognatio ignium transiliuntque in eam protinus undecumque visam. Ita ferunt a Medea pellicem crematam, postquam sacrificatura ad aras accesserat, corona igne rapta.

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235. *Astacenis,* Conj. Hard. Sill. *Austacenis,* RΘa. *Austagenis,* ADal. *Austragenis,* Td. — *rapta,* Al. Sill. May. *rapto,* TdJan.

THE NATURAL HISTORY
of
C. PLINIUS SECUNDUS

BOOK II.

Chap. CIV. Sect. 108. **235.** There is a lake at Samosata, a city of Commagene, which exudes an inflammable mud called maltha. It sticks to any solid body which it touches, and its power of adhesion enables it to pursue those who seek to flee from it. With this they defended their walls when besieged by Lucullus, and set his soldiery on fire, arms and all. Water makes it blaze more brightly, and experience has shewn that earth is the only thing which will extinguish it.

Chap. CV. Sect. 109. A similar substance is naphtha, a name given to an exudation like fluid bitumen, occurring in the neighbourhood of Babylon and among the Astaceni in Parthia. It is closely related to fire, which leaps upon it from any quarter as soon as it beholds it. With this they say Medea burned her husband's mistress, when fire seized upon her crown as she approached the altars to sacrifice.

LIBER IX.

Sect. 60. * * * * * * * * * *

Cap. XXXVI. **125.** Purpuræ vivunt annis plurimum septenis, latent sicut murices circa canis ortum tricenis diebus, congregantur verno tempore mutuoque attritu lentorem cuiusdam ceræ salivant. Simili modo et murices, sed purpuræ florem illum tinguendis expetitum vestibus in mediis habent faucibus. **126.** Liquoris hic minim*um* est in candida vena, unde pretiosus ille bibitur, nigrantis rosæ colore sublucens; reliquum corpus sterile. Vivas capere contendunt, quia cum vita sucum eum evomunt, et maioribus quidem purpuris detracta concha auferunt; minores cum te*sta* vivas frangunt, ita demum eum exspuentes.

127. Tyri præcipuus hic Asiæ, Menin*g*e Africæ et Gætulo litore Oceani, in Laconica Europæ. Huic fasces securesque Romanæ viam faciunt idemque pro maiestate pueritiæ est. Distinguit ab equite curiam, dis advocatur placandis omnemque vestem illuminat, in triumphali miscetur auro. Quapropter excusata et purpuræ sit insania; sed unde conchyliis pretia, quis virus grave in fuco, color austerus in glauco et irascenti similis mari?

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125. *mutuoque attritu*, WSill. May. *mutuumque attritum*, Rd.

126. *minimum*, Conj. Url. May. *minimi*, RdSill. *minime*, Al. *nimirum*, Conj. Dal. — *cum testa*, Conj. Hard. Sill. May. *cum terra*, Mss.

127. *Meninge*, May. *in Meninge*, Barb. Sill. *menige*, R^1 d. *minimus*, R^2. — *Huic*, Al. Sill. *Hinc*, K. Omit. RdMay. — *fasces*, Al. Sill. *fasces ut*, Rd. *fasces huic*, Conj. May. *fasces illi*, suggested, but not read, by Sillig. — *in glauco*, Mss. ? *et glauco*, Ed.

BOOK IX.

Sect. 60. * * * * * * * * * *

Chap. XXXVI. **125.** Purples live for seven years at most. Like the murex they lie hid for thirty days at the rising of the dog-star, and in spring they congregate and, as they rub against one another, they discharge a viscous saliva like a honeycomb in appearance. The murex has similar characteristics, but the purple bears in its throat that superb substance which is sought for dyeing garments. **126.** There, in a white vein, is a tiny drop of liquid from which the cloth soaks up that precious colour which gleams with the hue of a dark rose. It is found in no other part of the body. The purples are caught alive, if possible, for they give forth the liquid with their life. The larger purples are taken out of their shells before the liquid is removed : the smaller only exude the dye when crushed alive, shell and all.

127. The best quality is made in Asia at Tyre, in Africa at Meninx and on the Gaetulian shore of Oceanus, and in Europe in Laconia. This is the purple for which the Roman fasces and axes clear a way. It is the badge of noble youth; it distinguishes the senator from the knight; it is called in to appease the gods. It brightens every garment, and shares with gold the glory of the triumph. For these reasons, we must pardon the mad desire for purple, but why the high prices for the conchylian colour, a dye with an offensive smell and a hue which is harsh and greenish, like an angry sea.

128. Lingua purpuræ longitudine digitali, qua pascitur perforando reliqua conchylia; tanta duritia aculeo est. Aquæ dulcedine necantur, et sicubi flumen immergitur; alioqui captæ et diebus quinquagenis vivunt saliva sua. Conchæ omnes celerrime crescunt, præcipue purpuræ; anno magnitudinem implent.

Sect. 61. **129.** Quod si hactenus transcurrat expositio, fraudatam profecto se luxuria credat nosque indiligentiæ damnet. Quamobrem persequemur etiam officinas ut, tamquam in victu frugum noscitur ratio, sic omnes qui istis gaudent præmia vitæ suæ calleant.

Concharum ad purpuras et conchylia — eadem enim est materia, sed distat temperamento — duo sunt genera. Buccinum minor concha ad similitudinem eius qua buccini sonus editur, unde causa nomini, rotunditate oris in margine incisa. **130.** Alterum purpura vocatur, canaliculato procurrente rostro et canaliculi latere introrsus tubulato, qua proferatur lingua. Præterea clavatum est ad turbinem usque aculeis in orbem septenis fere qui non sunt buccino, sed utrisque orbes totidem quot habeant annos. Buccinum nonnisi petris adhæret circaque scopulos legitur.

Cap. XXXVII. **131.** Purpuræ nomine alio pelagiæ vocantur. Earum genera plura, pabulo et solo discreta: lutense putre limo et algense enutritum alga, vilissimum utrumque; melius tæniense in tænii*s* maris collectum, hoc quoque tamen etiamnum levius atque dilutius; ca*l*cule*n*se appellatur a calculo maris, mire aptum

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130. *canaliculato*, K. May. *caniculato*, RΘTd. *cuniculato*, Conj. Sill. *cuniculatim*, Conj. Barbarus, W. — *canaliculi*, K. May. *caniculi*, R. *canicula*, Θ. *cuniculi*, Sill. — *proferatur*, dWMay. *proseratur*, RSill.

131. *taeniis*, Conj. Turnebus, Sill. May. *tenaei*, R. *tenii*, d. *tenei*, Θr. — *calculense*, Conj. Hard. Sill. May. *cauculese*, R. *cauculosae*, d. *calculosae*, Dal. — *appellatur*, Conj. Brot, May. *appellant*~, R. *appellantur*, dDal. *appellant*, Sill. — *dialutense*, Conj. Dal. Sill. May. *dialucense*, Rd.

128. The purple has a tongue as long as one's finger. This spine is so hard that it uses it to perforate the shells of other shell-fish on which it feeds.

Purples perish in fresh water, and wherever a river enters the sea. Apart from this, they live on their own saliva, after capture, for as long as fifty days. All shell-fish grow rapidly, but especially purples, which attain maturity within a year.

Sect. 61. **129.** But if my account were to go no further, sybarites would certainly consider themselves cheated, and would condemn me for negligence. We will, therefore, discuss even the methods of the factory, in order that, to all who delight in such things, as full information may be available about that which they prize most in life, as we already possess about the fruits of the earth which nourish us.

Two kinds of shell-fish furnish the purple and the conchylian dyes — the colours used for both are the same, but they are mixed in different proportions. The smaller shell, buccinum, is like that with which the sound of a trumpet is produced (hence the name), and has a round mouth with a notch at one side. **130.** The other is called purpura, and has a projecting spine with a channel, from the side of which a tube passes inward and affords a passage for the tongue. In addition, it has spines right up to the apex, about seven on each whorl. These spines do not occur in the case of buccinum, but both varieties have as many whorls as they are years old.

The buccinum clings only to rocks, and is gathered around the cliffs.

Chap. XXXVII. **131.** Purples are also called *pelagiæ*. There are several varieties, distinguished by their food and their haunts. The least valuable kinds are he mud-purple and the sea-weed-purple which live on rotting mud and sea-weed respectively. The reef-purple, gathered on reefs, is better, but it too is somewhat

conchyliis, et longe optimum purpuris dialu*t*ense, id est vario soli genere pastum.

132. Capiuntur autem purpuræ parvulis rarisque textu veluti nassis in alto iactis. Inest iis esca, clusiles mordacesque conchæ ceu mitulos videmus. Has semineces, sed redditas mari avido hiatu reviviscentes, adpetunt purpuræ porrectisque linguis infestant; at illæ, aculeo exstimulatæ, claudunt sese comprimuntque mordantia. Ita pendentes aviditate sua purpuræ tolluntur.

Cap. XXXVIII. Sect. 62. **133.** Capi eas post canis ortum aut ante vernum tempus utilissimum, quoniam cum cerificavere fluxos habent sucos; sed id tinguentium officinæ ignorant, cum summa vertatur in eo. Eximitur postea vena quam diximus, cui addi salem necessarium, sextarios ferme centenas in libras. Macerari triduo iustum, quippe tanto maior vis, quanto recentior, fervere in plumbo, singulas *a*qu*a*e amphoras [centenas] atque quingentenas medicaminis libras æqua*l*i ac modico vapore torreri et ideo longinquæ fornacis cuniculo.

134. Ita despumatis subinde carnibus quas adhæsisse venis necesse est, decimo ferme die liquata cortina vellus elutriatum mergitur in experimentum et, donec spei satis fiat, uritur liquor. Rubens color nigrante deterior. Quinis lana potat horis rursusque mergitur carminata, donec omnem ebibat saniem.

Buccinum per se damnatur, quoniam fucum remittit; pelagio admodum alligatur, nimiæque eius nigritiæ dat austeritatem illam

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133. *singulas aquae amphoras*, Conj. May. *singulasque amphoras centenas*, Mss. Sill. *singulisque aquae amphoris centenas*, Conj. Dal. — *atque*, RdDal. May. *at*, P. *ad*, Conj. Hard. Sill. — *quingentenas*, Mss. Sill. May. *quinquagenas*, Conj. Dal. — *aequali*, Conj. Jan. May. *aequari*, Mss. Sill. *aquari*, Conj. Dal.

light and poor in colour. The pebble-purple is so called from the pebbles of the sea, and is remarkably suitable for dyeing. Finally, by far the best for purple is the *dialutense*, that is, one which has various feeding-grounds.

132. Purples are caught with a sort of small wicker basket cast into the deep, and containing as bait bivalves which snap their shells together, as mussels are known to do. These bivalves, though half-dead, revive on returning to the sea and gape open greedily. The purples seek them out and attack them with protruding tongue, but the mussels shut up as soon as they feel the sting, and hold their assailants fast. Thus suspended, the purples are taken up, caught by their own greed.

Chap. XXXVIII. Sect. 62. **133.** The best time to catch them is after the rising of the dog-star or before spring arrives, for, when they have produced the honeycomb-like exudation, the juice is too thin. Yet this fact, although of the utmost importance, is not recognised in the dye-factories. The vein already mentioned is then extracted and about a sextarius of salt added to each hundred pounds of material. It should be soaked for three days, for the fresher the extract, the more powerful the dye, then boiled in a leaden vessel. Next, five hundred pounds of dye-stuff, diluted with an amphora of water, are subjected to an even and moderate heat by placing the vessels in a flue communicating with a distant furnace.

134. Meanwhile the flesh which necessarily adheres to the veins is skimmed off, and a test is made about the tenth day by steeping a well-washed fleece in the liquefied contents of one of the vessels. The liquid is then heated till the colour answers to expectations. A frankly red colour is inferior to one with a tinge of black. The wool drinks in the dye for five hours and, after carding, is dipped again and again until all the colour is absorbed.

The buccine dye is considered unsuitable for use by itself, for it does not give a fast colour, but it is perfectly fixed by the pelagian, and it lends to the black hue of the latter that severity

nitoremque qui quæritur cocci. **135.** Ita, permixtis viribus, alterum altero excitatur aut adstringitur. Summa medicaminum — in *L* libras vellerum buccini ducenæ et e pelagio CX. Ita fit amethysti color eximius ille. At Tyrius pelagio primum satiatur immatura viridique cortina; mox permutatur in buccino. Laus ei summa in colore sanguinis concreti, nigricans adspectu, idemque suspectu refulgens, unde et Homero purpureus dicitur sanguis.

Cap. XXXIX. Sect. 63. **136.** Purpuræ usum Romæ semper fuisse video; sed Romulo in trabea, nam toga prætexta et latiore clavo Tullum Hostilium e regibus primum usum Etruscis devictis satis constat. Nepos Cornelius, qui divi Augusti principatu obiit, ‘ me ’, inquit, ‘ iuvene violacea purpura vigebat cuius libra denariis centum venibat, nec multo post rubra Tarentina. **137.** Huic successit dibapha Tyria quæ in libras denariis mille non poterat emi. Hac P. Lentulus Spinther ædilis curulis primus in prætexta usus improbabatur, qua purpura quis non iam, ’ inquit, ‘ triclinaria facit ? ’ Spinther ædilis fuit urbis conditæ anno DC*XCI*, Cicerone consule. Dibapha tunc dicebatur quæ bis tincta esset, veluti magnifico impendio, qualiter nunc omnes pæne commodiores purpuræ tinguntur.

Sect. 64. **138.** In conchyliata veste cetera eadem sine buccino, præterque ius temperatur aqua et pro indiviso humani potus excremento; dimidia et medicamina adduntur. Sic gignitur

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135. *L*, Conj. Hard. Sill. *M*, Conj. Detl. Omit. Mss. Dal. Mayhoff marks lacunae here and before *summa*. — *et e pelagio*, Conj. Sill. May. *pelagio*, K. *et e palatio*, R^1. *et e phelasio*, R^2. *te palatio*, d. *pelagii*, W. — *CX*, Conj. Hard. *CXI*, Mss. Sill. May.

137. *DCXCI*, Pighius, Hard. and later editors. *DC*, Mss.

138. *et pro indiviso*, RTdSill. May. *pro inviso*, S. *pro improviso*, Conj. Dal. — *dilutior*, RSSill. May. *dilucidior*, Td. — *quinquagenos*, Mss. Sill. May. *quingentos*, Conj. Salmasius.

and kermes-like sheen which is in fashion. **135.** Thus, by combining the qualities of both, the dark colour is made more brilliant and the bright colour more sober. To get the best dye, two hundred pounds of buccine extract and one hundred and ten of pelagian are used for every fifty pounds of wool. This gives the superb amethystine colour which is so well known. The Tyrian colour is obtained by first steeping the wool in a raw and unheated vat of pelagian extract, and then transferring it to one of buccine. It is most appreciated when it is the colour of clotted blood, dark by reflected, and brilliant by transmitted light. This is why Homer used the adjective ‘ purple ’ of blood.

Chap. XXXIX. Sect. 63. **136.** I observe that purple has been used at Rome since the earliest times, but Romulus only employed it in the *trabea*, for it is fairly certain that Tullus Hostilius was the first king to use the *toga prætexta* and the laticlave, after the conquest of the Etruscans. Cornelius Nepos, who died in the reign of the Emperor Augustus, said, “ The violet purple which cost a hundred denarii a pound was in fashion in my youth, followed, a little later, by Tarentine red. **137.** Next came the Tyrian *dibapha* which could not be purchased for a thousand denarii a pound. P. Lentulus Spinther, when curule ædile, was the first to use this dye for his *toga prætexta*, and incurred disapproval for employing a purple which ,” said Nepos, “ is now to be seen on every couch-cover ”. Spinther was aedile in the six hundred and ninety-first year of the city, the year of Cicero’s consulship. The name *dibapha* was given at this period to materials which had been ‘ twice-dipped ’, as though that were a matter of enormous expense, yet this method is employed for almost all the better purple stuffs of the present day.

Sect. 64. **138.** Conchyliated garments are prepared by a similar method, but no buccine extract is employed, and the dye is diluted simultaneously with water and with human urine. Only half

laudatus ille pallor, saturitate fraudata, tantoque dilutior quanto magis vellera esuriunt.

Cap. XL. Pretia medicamento sunt quidem pro fertilitate litorum viliora, non tamen usquam pelagii centenas libras quinquagenos nummos excedere et buccini centenos sciant qui ista mercantur immenso.

Sect. 65. **139.** Sed alia e fine initia, iuvatque ludere impendio et lusus geminare miscendo, iterumque et ipsa adulterare adulteria naturæ, sicut testudines tinguere, argentum auro confundere ut electra fiant, addere his aera, ut Corinthia.

Cap. XLI. Non est satis abstulisse gemmæ nomen amethystum; rursum absolutum inebriatur Tyrio, ut sit ex utroque nomen improbum simulque luxuria duplex, et cum confecere conchylia transire melius in Tyrium putant. **140.** Pænitentia hoc primum debet invenisse, artifice mutante quod damnabat. Inde ratio nata, votum quoque factum e vitio portentosis ingeniis, et gemina demonstrata via luxuriæ, ut color alius operiretur alio, suavior ita fieri leniorque dictus. Quin et terrena miscere coccoque tinctum Tyrio tinguere ut fieret hysginum.

141. Coccum Galatiæ rubens gra*num*, ut dicemus in terrestribus, aut circa Emeritam Lusitaniæ in maxima laude est. Verum ut simul peragantur nobilia pigmenta, anniculo grano languidus

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139. *lusus*, Mss. Sill. May. *luxus*, Conj. Salmasius.

140. *hysginum*, Early editors, Sill. May. *hisginum*, R. *his schynum*, d.

141. *granum*, Conj. apud Barb. Sill. May. *gramen*, ΘTdr. *gram̄*, R. — *grano*, RSill. May. *gramini*, ΘTdr.

the usual amount of dye is used. Thus, by cheating the wool of its full complement of dye, you achieve that pale shade which is so fashionable — the more you starve the wool, the paler the colour.

Chap. XL. The price of the dye depends on the yield of the coasts. I can, however, assure those who purchase purple at an extravagant figure, that the price of a hundred pounds of extract never exceeds fifty sesterces in the case of the pelagian, nor a hundred sesterces in the case of the buccine.

Sect. 65. **139.** But what seemed the goal is only the starting-point for fresh developments. We play joyfully at extravagance and every complication adds to the sport. We love to falsify a second time what is already a falsification of Nature, as when we stain tortoise-shell, or mingle silver with gold to obtain electrum and then add copper to make Corinthian metal.

Chap. XLI. We are not content with stealing the name ‘ amethyst ’ from that precious stone; when the amethystine fabric is perfected we steep it again in Tyrian dye, that both may contribute to its monstrous name and that luxury may be redoubled. When conchyliated material too is finished, it is thought better to transfer it to a Tyrian vat. **140.** This discovery must have been due, in the first instance, to some workman who changed his mind and redyed an article with which he was dissatisfied. Thus a new method came into existence, unnatural minds changed a fault into a fashion, and a double path of luxury was opened up, by which one colour was considered more bland and mellow when veiled by another. Nay, purple is mingled even with colours of terrestrial origin, and stuff dyed with kermes is re-dyed with Tyrian purple to produce *hysginum.*

141. The red kermes-berry found in Galatia, or near Emerita in Lusitania, is in the greatest demand, as we shall relate when discussing the fruits of the earth. It is here included, that the noble dyes may be mentioned together. The extract from berries in their first year is weak, while that from berries four years old

sucus, idem a quadrimo evanidus; ita nec recenti vires neque senescenti.

Abunde tractata est ratio, qua se virorum iuxta feminarumque forma credit amplissimam fieri.

gives only a transient colour. Thus the best dye is obtained neither from the berries which are too young nor from those which are too old.

Enough has been said concerning the art by which men and women alike consider their beauty most enhanced.

LIBER XIX.

Cap. III. * * * * * * * * * *

Sect. 17. **47.** Sunt etiamnum duo genera non nisi sordido nota vulgo, cum quæstu multum polleant. In primis rubia tinguendis lanis et coriis necessaria; laudatissima Italica et maxime suburbana, et omnes pæne provinciæ scatent ea. Sponte provenit seriturque similitudine erviliæ, verum spinosis *foliis* et caule; geniculatus hic est quinis circa articulos in orbe foliis; semen eius *rubrum*, *radix* rubra est. Quos in medicina usus habeat, dicemus suo loco.

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47. *spinosis*, DAdMay. *spinosus*, Al. Sill. — *foliis et caule*, Conj. May. *et caule*, Mss. *ei caulis*, Early ed., Sill. — *semen eius rubrum, radix rubra est*, Ed. *semen eius rubia est*, Mss. *semen eius rubrum est*, Conj. Barb. Sill. Sillig also suggested (from Diosc. 3, 160) *semen eius viride, tum rubrum, postremo nigrum est. Rubia quos...* Mayhoff reads *semen eius rubrum, postremo nigrum, radix rubra est.*

BOOK XIX.

Chap. III. * * * * * * * * * *

Sect. 17. **47.** There are moreover two plants whose commercial value makes them of interest only to the vulgar. Of prime importance is madder, used for dyeing wool and leather. Italian madder, especially that grown near the City, is the most popular, but it abounds in almost all the provinces. It is usually self-set, but it may also be sown like the vetch, from which it differs in having barbs on the leaves and stem. The latter is jointed and has a circle of five leaves round each joint. The seeds and root of the plant are red. Its medical applications will be related in the appropriate place.

LIBER XXXI.

Cap. VII. Sect. 39. **73.** Sal omnis aut fit aut gignitur, utrumque pluribus modis, sed causa gemina, coacto umore vel siccato. Siccatur in lacu Tarentino æstivis solibus totumque stagnum in salem abit, modicum alioqui, altitudine genua non excedens; item in Sicilia in lacu qui Cocanicus vocatur et alio iuxta Gelam. Horum extremitates tantum inarescunt, sicut in Phrygia, Cappadocia, Aspendi, ubi largius coquitur et usque ad medium. **74.** Aliud etiam in eo mirabile, quod tantundem nocte subvenit quantum die auferas. Omnis e sta*g*nis sal minutus atque non glæba est.

Aliud genus ex aquis maris sponte gignitur, spuma in extremis litoribus ac scopulis relicta; hic omnis *sol*e densatur et est acrior qui in scopulis invenitur.

75. Sunt etiamnum differentiæ tres. Namque in Bactris duo lacus vasti, alter ad Scythas versus, alter ad Arios, sale exæstuant, sicut ad Citium in Cypro et circa Memphim; extrahunt e lacu, dein sole siccant. Sed et summa fluminum densantur in salem, amne reliquo veluti sub gelu fluente, ut apud Caspias portas quæ salis flumina appellantur; item circa Mardos et Armenios. **76.** Præ-

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73. *medium*, VR^1 Jan. May. *medium lacum*, dR^{2}W Sill.

74. *e stagnis*, Conj. Sill. May. *est alnis*, VR^1 d. *est omnis*, R^2. *est talis*, W. — *sole*, Pontedera (antiq. Gr. et Lat. p. 613) (see note), Sill. *rore*, Mss. W. May. *solis calore* Jan (ex Vinc. Bellor. spec. nat. 6, 83).

76. *et apud*, VR^1 dMay. *apud*, R^2 Sill. — *ex his adpositis*, Mss. Sill. *ex adpositis*, WDetl. May.

BOOK XXXI.

Chap. VII. Sect. 39. **73.** Salt is of two kinds, that which is prepared by man and that which occurs in nature. In each case there are several varieties but two ultimate causes, the condensation and the evaporation of moisture. In the lake at Tarentum the water is evaporated by the summer sun, and the whole pool, which is rather small and nowhere more than knee-deep, turns into salt. The same thing occurs in Sicily in Lake Cocanicus and in a lake near Gela, but in these cases only the edges of the lake dry up. This happens also in Phrygia, in Cappadocia, and at Aspendus, where evaporation covers a wider area, as much as half the lake. **74.** Another remarkable feature in the latter case is the fact that the salt removed by day is restored by night. Lake-salt is granular and never occurs in large masses.

A second kind is produced spontaneously from sea-water, when spray, left on rocks and on the upper reaches of the shore, is concentrated by the sun. The salt found on rocks has a sharper taste than other salt.

There are three further variations of naturally occuring salt. **75.** In Bactria there are two vast lakes, one towards Scythia, the other towards Ariana, which seethe with salt, just as at Citium in Cyprus, and around Memphis. The salt is drawn from the lake and dried in the sun. Again, the surfaces of rivers solidify into salt, beneath which the rest of the river flows as if beneath a sheet of ice. This happens in the case of the "salt-rivers" near the Caspian Gates, and among the Mardians and the Armenians. **76.** Moreover, the Bactrian rivers, Ochus and Oxus,

terea et apud Bactros amnes Ochus et Oxus ex his adpositis montibus deferunt salis ramenta. Sunt et in Africa lacus et quidem turbidi salem ferentes. Ferunt quidem et calidi fontes, sicut Pagasæi. Et hactenus habent se genera ex aquis sponte provenientia.

77. Sunt et montes nativi salis, ut *in* Indis Oromenus in quo lapicidinarum modo cæditur renascens, maiusque regum vectigal ex eo est quam ex auro atque margaritis. Effoditur et e terra, ut palam est umore densato, in Cappadocia. Ibi quidem cæditur specularium lapidum modo; pondus magnum glæbis quas micas vulgus appellat.

78. *Ge*rr*h*is Arabiæ oppido muros domosque massis salis faciunt, aqua feruminantes. Invenit et iuxta Pelusium Ptolemæus rex, cum castra faceret, quo exemplo postea inter Ægyptum et Arabiam etiam squalentibus locis coeptus est inveniri detractis harenis, qualiter et per Africæ sitientia usque ad Hammonis oraculum, is quidem crescens cum luna noctibus. Nam Cyrenaici tractus nobilitantur Hammoniaco, et ipso quia sub aris inveniatur appellato.

79. Similis est colore alumini quod schiston vocant, longis glæbis neque perlucidis, ingratus sapore sed medicinæ utilis; probatur quam maxime perspicuus, rectis scissuris. Insigne de eo proditur quod, levissimus intra specus suos, in lucem universam prolatus vix credibili pondere ingravescat; causa evidens, cuniculorum spiritu madido sic adiuvante molientes ut adiuvant aquæ.

80. Adulteratur Siculo quem Cocanicum appellavimus, nec non et Cyprio mire simili. In Hispania quoque citeriore Egelestæ cæditur glæbis pæne tralucentibus, cui iam pridem palma a plerisque medicis inter omnia salis genera perhibetur. Omnis locus in quo reperitur sal sponte nascens sterilis est, nihilque gignit in totum. † intra hæc †.

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77. *in Indis*, Early ed., Sill. May. *Indis*, Mss. Detl.

78. *Gerrhis*, Conj. Hard. (v. notes), Sill. May. *Carris*, Mss. Dal. — *aris*, Conj. Ed. *harenis*, Mss.

80. *sal sponte nascens*, r. *sal*, Mss. Sill. May. — *in totum*, r. *et in totum sponte nascens*, Mss. Sill. May.

carry down particles of salt from the hills over against them, and certain lakes in Africa are actually turbid with salt. Hot springs too are sometimes salt-bearing, witness those of Pagasa. So much for the varieties of salt which are spontaneously produced from water.

77. Mountains of salt are found, like Oromenus in India, where it is quarried like stone and renews itself, and kings derive a greater proportion of their income from salt than from gold and pearls. In Cappadocia it is dug out of the earth, where it has clearly been formed by the condensation of moisture, and may indeed be hewn like *lapis specularis*. The lumps are of great weight and are popularly known as *micæ*.

78. At Gerrhae, a town in Arabia, walls and houses are made with blocks of salt, cemented together with water. King Ptolemy also found salt near Pelusium, when he was camping there, and later it was similarly discovered, when the sand had been removed, in the parched districts between Egypt and Arabia, and in the thirsty lands of Africa as far as the oracle of Hammon, where it grows with the moon of nights. For the country round Cyrene is famous for the salt of Hammon, so called because it is found close to the altars of that deity. **79.** It resembles *alumen schiston* in colour, and occurs in long, opaque pieces, unpleasant to the taste but useful in medicine. The more transparent it is, the better, and it should have a rectilinear cleavage. It is said to have this remarkable quality that, though very light in the mines where it is found, it increases in weight to an extent which is scarcely credible when brought to the light of day. The reason is obvious; the moist vapour of the mines renders the miners an assistance like that of water. **80.** It is adulterated with the Sicilian salt which we have named Cocanicum, and with Cyprian salt which is marvellously like it. Salt is mined also, in almost transparent lumps, at Egelesta in Hither Spain, and most doctors have long given this variety the palm over other kinds of salt.

Every place in which salt naturally occurs is barren, and brings forth no fruit of any description.

81. Facticii varia genera, vulgaris plurimusque in salinis, mari adfuso, non sine aquis dulci*bu*s riguis, sed imbre maxime iuvante ac super omnia sole multo, aliter non inarescens. Africa circa Uticam construit acervos salis ad collium speciem, qui, ubi sole lunaque induruere, nullo umore liquescunt vixque etiam ferro cæduntur. Fit tamen et in Creta sine riguis mare in salinas infundentibus, et circa Ægyptum ipso mari influente in solum, ut credo, Nilo sucosum. **82.** Fit et puteis in salinas ingestis. Prima densatio Babylone in bitumen liquidum cogitur oleo simile, quo et in lucernis utuntur; hoc detracto subest sal. Et in Cappadocia e puteis ac fonte aquam in salinas ingerunt. In Chaonia excoquunt aquam e fonte, refrigerandoque salem faciunt inertem nec candidum.

Galliæ Germaniæque ardentibus lignis aquam salsam infundunt; (Sect. 40. **83.**) Hispaniæ quadam sui parte e puteis hauriunt, muriam appellantes; illi quidem et lignum referre arbitrantur. Quercus optima, ut quæ per se cinere sincero vim salis reddat, alibi corylus laudatur. Ita, infuso liquore salso, carbo etiam in salem vertitur. Quicumque ligno confit sal niger est. Apud Theophrastum invenio Umbros harundinis et iunci cinerem decoquere aqua solitos, donec exiguum superesset umoris. Quin et e muria salsamentorum recoquitur iterumque, consumpto liquore, ad naturam suam redit; vulgo e menis iucundissimus.

Sect. 41. **84.** Marinorum maxime laudatur Cyprius a Salamine, de stagnis Tarentinus ac Phrygius qui Tattæus vocatur; hi duo

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81. *Facticii,* Ed. *intra haec est. Facticii,* R^2 dSill. May. *intra haec. Facticii,* VR^1. *Sunt inter haec facticii,* r. — *aquis,* VRaMay. *aquae,* dWSill. — *dulcibus,* Conj. May. *dulcis,* Mss. WSill. — *multo,* TdaWDetl. *multoque* VRJan. *multo atque,* Conj. Sill. *multo...que,* May., who considers that some word like *adsiduo* has fallen out.

82. *e fonte,* Conj. May. *et fonte,* aR^2. *fonte,* VR^1 d. *ex fonte,* WSill.

83. *carbo,* Al. Sill. *arbor,* aDetl. May.

84. *de stagnis,* Al. Sill. *ad e stagnis,* R^2 *at e stagnis,* Dal. May.

81. There are various kinds of artificial salt, most of it being made by the common process of leading the sea into salterns, with streams of fresh water. Rain-water, however, is the most helpful, and a hot sun is indispensable — otherwise the brine does not evaporate to dryness. Africa rears up its heaps of salt like hills near Utica, and when they have been hardened by sun and moon, water cannot dissolve them and even iron can scarce cut them. Yet salt is prepared in Crete without any addition of fresh water by leading the sea into salterns, as well as in Egypt, where the sea itself washes up into land sodden, I understand, by the Nile. **82.** Again, salt is prepared by driving well-water into salt-deposits. In Babylon, the first product to separate out on condensation is a fluid and oily bitumen, which is used for lamps — this once removed, the salt is found underneath. In Cappadocia, too, they drive well- and spring-water into the deposits. In Chaonia they boil spring-water, which on cooling deposits a salt which has neither transparency nor savour.

In Gaul and Germany, salt water is poured on burning logs. (Sect. 40) **83.** In a certain part of Spain, the salt water is drawn from wells and called *muria*. The Spaniards indeed consider the nature of the wood to be a matter of importance. Oak-wood is best, for its ashes, even when not thus treated, have a saltiness of their own; elsewhere hazelwood is praised. So, when the salt water is poured on, even the charcoal is turned into salt. Salt made with wood is always black. I find in Theophrastus that the Umbri used to boil down the ashes of reeds and rushes with water, until the liquid had been reduced to a small bulk. Why, salt can even be recovered by heat from brine used for pickling; when the liquid is all gone, the salt is found unchanged. Most people prefer the brine used for *menæ* for this purpose.

Sect. 41. **84.** The best sea-salt comes from Salamis in Cyprus, while the best lake-salts are the Tarentine and the Phrygian

oculis utiles. E Cappadocia qui laterculis adfertur cutis nitorem dicitur facere. Magis tamen extendit is quem Citium appellavimus, itaque a partu ventrem eo cum melanthio inlinunt.

85. Salsissimus sal qui siccissimus, suavissimus omnium Tarentinus atque candidissimus, et de cetero fragilis qui maxime candidus. Pulvia dulcescit omnis; suaviorem tamen rores faciunt, sed copiosum aquilonis flatus. Austro non nascitur. Flos salis non fit nisi Aquilonibus. In igne nec crepitat nec exsilit Tragasæus neque Acanthius, ab oppido appellatus, nec ullius spuma aut rament*a* tenui*a*. Agrigentinus, ignium patiens, ex aqua exsilit.

86. Sunt et colorum differentiæ. Rubet Memphi, rufus est circa Oxum, Centuripis purpureus, circa Gelam in eadem Sicilia tanti splendoris ut imaginem recipiat, in Cappadocia crocinus effoditur, tralucidus et odoratissimus. Ad medicinæ usus antiqui Tarentinum maxime laudabant, ab hoc quemcumque e marinis, ex eo genere spumeum præcipue, iumentorum vero et boum oculis Tragasæum et *Ba*eticum. **87.** Ad opsonium et cibum utilior quisque facile liquescit, item umidior; minorem enim amaritudinem habent, ut Atticus et Euboicus. Servandis carnibus aptior acer et siccus, ut Megaricus. Conditur etiam odoribus additis et pulmentarii vicem implet, excitans aviditatem invitansque in omnibus cibis, ita ut sit peculiaris ex eo intellectus inter innumera condimenta, item in mandendo quæsitus garo.

88. Quin et pecudes armentaque et iumenta sale maxime solli-

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85. *et*, Mss. Sill. *est*, Conj. Url. Detl. *set*, Conj. May. — *nec ullius*, R^2 dSill. May. *nec ullus*, T. *ne ullus*, VR^1. — *spuma*, VRSill. May. *e spuma*, d. *ex spuma*, T. — *ramenta tenuia*, Conj. Ed. *ramento aut tenuis*, Mss. *ramentum aut tenuis*, Sill. Jan. *ramentum tenuis*, Detl. *ramentum tenuius*, May.

86. *Baeticum*, Early ed Sill. May. *Peticum*, VR^2 da. *Piicum*, R^1.

87. *item (in mandendo)*, a^{2}ωMay. *ita*, a^1. *ita est*, W. *iterum*, ΘVRTdSill. *interim*, Conj. Jan. *ciborum*, Conj. Detl. Om. Url.

88. *multo tum*, Conj. May. *multum*, Mss. Sill. *multo*, W. — *largiore*, RWJan. May. *largiores*, Al. Sill. — *quoque*, Ed. (v. note). *animi quoque*, Mss. — *animi*, Conj. Ed. (v. note). *nimia*, Mss. *samnia*, K. *scommata*, conj. Pint. Sill. *nam ita*, Conj. Barb. W. *eximias*, Conj. May.

which is known as Tattaean, the two latter being good for the eyes. The variety which is imported in slabs from Cappadocia is said to produce a clear skin, but for removing wrinkles Citian salt is more effective, and so they mix it with *melanthium* and smear it on the abdomen after child-birth.

85. The driest varieties taste most salty. Tarentine salt, which is the whitest of all, is also the blandest, and, for the rest, the whitest salts are the most brittle. All are sweetened by rain, while dew gives a blander salt. Salt is deposited plentifully during northerly gales, and not at all when the wind is from the south. Flower of salt is produced only when the wind is northerly. Neither Tragasaean salt nor Acanthian (named after that city), nor spray-salt from any source, nor finely-divided salt crackles or leaps in the fire, while Agrigentine salt, which is unaffected by fire, leaps out of water.

86. Variations in colour occur, salt being red at Memphis, reddish near the Oxus, and purple at Centuripae, while near Gela, which is also in Sicily, it glistens so as to present a reflecting surface, and, when mined in Cappadocia, it is saffron-coloured, translucent, and very pleasantly scented. For medical use our ancestors held Tarentine salt in the highest esteem, and after it any sea-salt, especially that deposited by the spray. For treating the eyes of oxen and beasts of burden, Tragasaean and Baetic salt were used.

87. All the best kinds for seasoning food deliquesce easily, and are therefore moister, for these varieties, like Attic and Euboeic, are less bitter. Dry and bitter salt, such as Megarian, is more suitable for preserving meat. Salt is even spiced and bottled, for use as a relish. No matter what the food, it excites the appetite and stimulates it so that one easily picks out its flavour amid a multitude of condiments, and it is this same flavour which attracts those who eat *garum* (fish-sauce). **88.** Why, it is particularly

citantur ad pastus, mul*to* tum largiore lacte, multoque gratiore etiam in caseo dote. Ergo, Hercules, vita humanior sine sale non quit degere, adeoque necessarium elementum est ut transierit intellectus ad voluptates quoque animi; sales appellantur, omnisque vitæ lepos et summa hilaritas laborumque requies non alio magis vocabulo constat.

89. Honoribus etiam militiæque interponitur, salariis inde dictis, magna apud antiquos auctoritate, sicut apparet ex nomine salariæ viæ, quoniam illa salem in Sabinos portari convenerat. Ancus Marcius rex salis modios $\overline{\text{VI}}$ in congiario dedit populis et salinas primus instituit. Varro etiam pulmentarii vice usos veteres auctor est, et salem cum pane esitasse eos proverbio apparet. Maxime tamen in sacris intellegitur auctoritas, quando nulla conficiuntur sine mola salsa.

Sect. 42. **90.** Salinarum sinceritas summam fecit suam differentiam, quandam favillam salis quæ levissima ex eo est et candidissima. Appellatur et flos salis in totum diversa res umidiorisque naturæ et crocei coloris aut rufi, veluti robigo salis, odore quoque ingrato ceu gari, dissentiens a sale, non modo a spuma. Ægyptus invenit videturque Nilo d*e*ferri, et fontibus tamen quibusdam innatat. **91.** Optimum ex eo quod olei quandam pinguitudinem reddit; est enim etiam in sale pinguitudo, quod miremur. Adulteratur autem tinguiturque rubrica aut plerumque testa trita, qui fucus aqua deprehenditur diluente facticium colorem, cum verus ille non nisi oleo resolvatur et unguentarii propter colorem eo maxime utantur. Canitia in vasis summa est, media vero pars umidior,

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89. *antiquos,* RSill. *antiquos et,* VdMay.

90. *quandam,* Al. Sill. *quadam,* aGel. May. — *favillam,* Mss. Sill. *favilla,* Gel. May. — *deferri,* Early Editors, May, Sill. *differri,* R^2 da. *differi,* VR^1.

effective in giving even sheep and cattle and baggage-animals such an appetite for pasture that they give a much more plentiful supply of milk, which furnishes cheese of a far more pleasing quality. Therefore, by Hercules, salt is an essential to civilised existence, and so necessary is this substance that the word which denotes it has come to be used also of pleasures of the mind; these are called *sales*, and no other word can better sum up all the grace of life, the height of merriment, and recreation after toil.

89. Even in military awards it finds its place, and the word *salarium* (salt-money) is derived from it. It was held in high honour among the ancients, as is clear from the name *salaria via*, a road so called because along it the Sabines were permitted to import salt. King Ancus Marcius gave six thousand modii of salt as a largess to the people, and was the first to open salterns. Varro also tells us that our ancestors used salt as a seasoning and it is clear from the proverb that they ate it with bread. It is in sacred rites, however, that it admittedly achieves its highest importance, for no offerings are perfect without salted spelt.

Sect. 42. **90.** Pits that furnish pure salt have this chief distinguishing characteristic, that they produce *favilla salis* (ash of salt), which is really the finest and whitest part of the salt. What is called *flos salis* (flower of salt) is a totally different substance, of a moister character and saffron or red colour, a kind of rust of salt with an unpleasant odour like that of *garum*, and differing from salt as well as from spray. It is an Egyptian discovery and is supposed to be borne down by the Nile, although it floats on the water of certain springs also. **91.** The best quality has a certain oily richness such as, strange to say, is possessed by salt also. It is, however, adulterated and coloured with ochre or, more often, with powdered potsherds. This falsification can be detected by washing out the added colouring matter with water, while the genuine substance is soluble only in oil, and is widely used by unguent-makers for the sake of its colour. When kept in jars, it acquires a white surface crust, but the part below is

ut diximus. **92.** Floris natura aspera, excalfactoria, stomacho inutilis; sudorem ciet, alvum solvit in vino et aqua, acopis et smeg*ma*tis utilis; detrahit et ex palpebris pilos efficacissime. Ima fæcis concutiuntur ut croci colore redeat.

Præter hæc etiamnum appellatur in salinis salsugo, ab aliis salsilago, tota liquida, marina aqua salsior, vi distans.

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Cap. X. Sect. 46. **106.** Non est differenda et nitri natura, non multum a sale distans, et eo diligentius dicenda quia palam est medicos qui de eo scripserunt ignorasse naturam nec quemquam Theophrasto diligentius tradidisse. Exiguum fit apud Medos canescentibus siccitate convallibus, quod vocant halmyraga, minus etiam in Thracia iuxta Philippos, sordidum terra, quod vocant agrium. **107.** Nam quercu cremata nunquam multum factitatum est et iam pridem in totum omissum. Aquæ vero nitrosæ pluribus locis reperiuntur, sed sine viribus densandi.

Optimum copiosumque in Clitis Macedoniæ, quod vocant Chalastricum, candidum purumque, proximum sali. Lacus est nitrosus, exsiliente e medio dulci fonticulo; ibi fit nitrum circa canis ortum novenis diebus totidemque cessat, ac rursus innatat et deinde cessat; (**108.**) quo apparet soli naturam esse quæ gignat, quoniam

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92. *smegmatis*, KHard. Sill. (*z*). *zmeticis*, VR^2 d. *zmedicis*, R^1. *smegtizis*. T. *smegmaticis*, Dal. *zmecticis*, Jan. May. — *efficacissime. Ima faecis*, Conj, Ed. *Ima faecis* (or *fecis*), aR^2 Detl. May. *efficacissime. Faeces*, dSill. *efficacissime. Faeces imae*, W. *imae ficis*, V. *ime effecis*, R^1.

107. *Clitis*, VRdMay. *Litis*, Hard. Sill. *Chyris*, K. *Clytis*, Dal. *Chaetis* or *Letis*, Barb.

108. *nec effluere*, aDal. Detl. (*neque*...May.) *neque fluere*, Al. Sill. — *Iis*, dWMay. *His*, VRSill. — *limum... Aegypto* follows Mayhoff's punctuation. Sillig punctuates *limum; et hoc quidem nascitur*. (**109**) *In Aegypto...*

moister, as we said before. **92.** *Flos salis* is pungent and warming, but is not good for the stomach. It promotes sweating and, if taken with wine or water, acts as a purgative, and is a useful ingredient of *acopa* and cleansing ointments. It removes hair from the eyelids. The dregs at the bottom must be stirred up to restore the saffron colour.

Besides these, there occurs in salt mines what some call *salsugo*, others *salsilago*. This is entirely liquid, salter than sea-water and differing from it in efficacy.

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Chap. X. Sect. 46. **106.** We must not postpone an account of the character of nitrum, a substance rather like salt, and one which should be described all the more diligently because it is clear that the physicians who have written about it were ignorant of its true character, and that the most precise information was given by Theophrastus. It is produced in small quantities, under the name *halmyrax*, in Media, where the valleys whiten in the dry season, and in still smaller amount in Thrace near Philippi, contaminated with earth, and known as ‘ wild ’ nitrum. **107.** The quantity made by burning oak-wood was never great, and the practice has long since been entirely abandoned. Nitrum-containing waters are found in several places, but they are not strong enough to repay concentration.

Clitae in Macedonia furnishes the best and most plentiful supply, to which the name Chalastrian is given : it is white and pure, very like salt. There is a nitrum-bearing lake, in the midst of which wells up a little fount of fresh water. There nitrum is formed for nine days about the rising of the dog-star, next disappears for as many days, and again it appears on the surface and then vanishes. **108.** It is clear from this that its production depends

compertum est nec soles proficere quicquam cum cessat nec imbres. Mirum et illud, scatebra fonticuli semper emicante, lacum neque augeri nec effluere. Iis autem diebus quibus gignitur si fuere imbres, salsius nitrum faciunt, aquilones deterius quia validius commovent limum. **109.** Et hoc quidem nascitur; in Ægypto autem conficitur multo abundantius sed deterius, nam fuscum lapidosumque est. Fit pæne eodem modo quo sal, nisi quod salinis mare infundunt, Nilum autem modo nitrariis. Hæc, cedente Nilo, siccant*ur*, *tam*en madent suco nitri XL diebus continuis, non ut in Macedonia statis. Si et imbres adfuerunt, minus e flumine addunt, statimque ut densari coeptum est rapitur ne resolvatur in nitrariis.

110. Sic quoque olei natura intervenit, ad scabiem animalium utilis; ipsum autem conditum in acervis durat. Mirum in lacu Ascanio et quibusdam circa Chalcida fontibus summas aquas dulces esse potarique, inferiores nitrosas. In nitro optimum quod tenuissimum et ideo spuma melior, ad aliqua tamen sordidum, tamquam ad inficiendas purpuras tincturasque omnes; magnus et vitro usus qui dicetur suo loco.

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109. *autem modo nitrariis*, conj. Jan. *autem nitrariis*, aW Detl. Sill. *autem monstraris*, VRd. *autumno nitrariis*, Conj. May. — *haec*, Al. Sill. (v. note). *hae*, dHard. Jan. May. — *cedente*, Al. Sill. *cedentem*, a. *accedente*, Conj. May. — *Nilo*, R^2 dSill. May. Om. VR^1 T. — *siccantur*, *tamen*, Conj. Ed. *siccant' decedente*, R^2 Dal. *siccant' decedentem*, a. *rigantur decedente*, Conj. May. Om. Al. Sill. — *madent*, VR^2 Sill. May. *madant*, R^1. *manant*, Td. — *et*, VR^1 dSill. *etiam*, R^2 WMay.

110. *sic*, Mss. Sill. *Hic*, KMay. — *inferiores*, RdWMay. *interiores*, ΘVSill.

on the nature of the soil, for it has been ascertained that, when it vanishes, neither sun nor rain is of any avail. This too is marvellous that, though the gushing fountain ever flashes up, the lake does not rise, although it has no outlet. Rain, however, if it comes on those days on which the nitrum is being produced, gives a salter product, while an inferior nitrum is obtained when the wind blows from the north, because it stirs up the mud too strongly.

109. So much for nitrum which occurs as such. In Egypt, however, it has to be prepared; the quantity is much greater but the quality poorer, for it is dark-coloured and stony. It is prepared in almost the same way as salt, except that the sea is turned into salterns, the Nile into nitrum-pits.

The latter dry up as the Nile retreats, but remain moist with the nitrum-bearing liquid for forty days on end, instead of yielding intermittently as in the case of Macedonia. If it rains during this period, they add less river-water, and the nitrum is hastily collected as soon as it begins to be deposited, for fear it should dissolve back into the nitrum-pits.

110. In this case also its properties include an oiliness, which makes it a remedy for itch in animals. When piled in heaps, however, it becomes hard. It is a curious fact that, in the case of Lake Ascanius and certain springs near Chalcis, the surface waters are fresh and potable, though the deeper waters hold nitrum in solution. The best nitrum is exceedingly light — it is this quality that gives to ‘ foam of nitrum ’ its superiority — but for some purposes, such as dyeing cloth with purple and other dyestuffs, the impure substance is useful. Its use in large quantities for the manufacture of glass will be set forth in the proper place.

111. Nitraria*e* Ægypti circa Naucratim et Memphim tantum solebant esse, circa Memphim deteriores; nam et lapidescit ibi in acervis, multique sunt cumuli ea de causa saxei. Faciunt ex his vasa, nec non frequenter liquatum cum sulphure coquentes. In cor*po*ribus quoque qua*e* inveterari volunt illo nitro utuntur. Sunt ibi nitrariæ in quibus et rufum exit a colore terræ.

112. Spumam nitri, quæ maxime laudatur, antiqui negabant fieri nisi cum ros cecidisset, prægnantibus nitrariis sed nondum parientibus, itaque non fieri incitatis, etiam si caderet; alii acervorum fermento gigni existimavere. **113.** Proxima ætas medicorum aphronitrum tradidit in Asia colligi, in speluncis mollibus destillans — specus eos † colligas † vocant — dein siccant sole. Optimum putatur Lydium : probatio ut sit minime ponderosum et maxime friabile, colore pæne purpureo. Hoc in pastillis adfertur, Ægyptium in vasis picatis ne liquescat; vasa quoque ea sole inarescentia perficiuntur.

114. Nitri probatio ut sit tenuissimum et quam maxime spongeosum fistulosumque. Adulteratur in Ægypto calce; deprehenditur gustu, sincerum enim statim resolvitur, adulteratum pungit calce, et aspersum reddit odorem vehementem. Uritur in testa opertum ne exsultet : alias igni non exsilit nitrum nihilque gignit aut alit, cum in salinis herbæ gignantur et in mari tot animalia,

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111. *Nitrariae*, Conj. Hard. Sill. May. *Nitrarias*, VR^1 Td. *Nitri egri*, R^2 Cod. Salmas. *Nitriae agri* (*Aegyptiaci*), Salmas. — *corporibus*, Conj. Ed. *carbonibus*, Mss. WSill. *carnibus*, Conj. May. — *quae*, W (with *ad ea* before *quoque*). *quas*, Mss. May. *quos*, Conj. Sill.

113. *colligas*, VR^1 dTa^2 Jan. May. *colligans*, a^1 R^2. *collicas*, Conj. Hard. *colicus*, Conj. Brot. *colycas*, Conj. Sill. (who suggests also σκώληκας). *corycias*, Conj. Detl. Mayhoff suggests *collicias*. (See note). —*siccant*, Mss. Sill. *siccari*, KMay. — *paene*, dWMay. *pane*, VR^1. *plene*, Salmas. R^2 Sill.

114. *et aspersum*, May. *aspersum*, dSill. *aspersu*, R. *et aspersu*, ΘV.

111. In Egypt, nitrum-beds used to be found only in the neighbourhood of Naucratis and Memphis. The latter are inferior, for there the heaps of nitrum petrify, and many mounds have thus turned into rocks from which vessels are made. Often, too, the substance is melted and heated with sulphur. Again, nitrum is used for mummifying bodies. Some of the nitrum-beds of this country furnish also a nitrum coloured red by the surrounding earth.

112. The ancients considered that ' foam of nitrum ', a substance of the highest reputation, is formed only when the dew falls, and when the nitrum-beds, though pregnant, are not yet in travail, and that accordingly none is formed when they are at the point of delivery, even though the dew should fall. Others have come to the conclusion that it is formed by the fermentation of the heaps. **113.** Physicians of the next generation taught that *aphronitrum* (' foam of nitrum ') is collected in Asia, where it drips down in humid caves, called *colligæ*, and is dried in the sun. Lydian is considered the best, the criteria being low density and great friability, combined with an almost purple colour. It is imported in tablet form, while the Egyptian kind comes in vessels pitched to prevent deliquescence — vessels which are finished by drying in the sun.

114. The qualities required of nitrum are lightness, sponginess and porosity. In Egypt it is sophisticated with lime, an impurity which is detected by the tongue, for, when pure, nitrum dissolves immediately, but, when adulterated, it burns by reason of the lime, and, if sprinkled with water, gives a strong smell. Nitrum is heated in an earthen vessel, with a lid to prevent spitting : apart from this, it does not crackle in the fire. It neither produces nor supports life, while vegetation grows in salterns and the sea teems with so many animals and so much sea-weed.

tantum algæ. **115.** Sed maiorem esse acrimoniam nitri apparet non hoc tantum argumento sed et illo, quod nitrariæ calciamenta protinus consumunt, alias salubres oculorumque claritati utiles. In nitrariis non lippiunt; ulcera adlata eo celerrime sanantur, ibi facta tarde; ciet et sudores cum oleo perunctis corpusque emollit. In pane, salis vice, utuntur Chalastræo, ad raphanos Ægyptio; teneriores eos facit, sed opsonia alba et deteriora, olera viridiora.

115. But the greater bitterness of nitrum (as compared with salt) is clear, not from this evidence only, but also from the fact that the nitrum-pits cause rapid deterioration of shoe-leather, although, on the other hand, they are healthy and good for the eyes. Ophthalmia is unknown in their neighbourhead, and ulcers brought to the district heal very quickly, though those formed locally mend slowly. Nitrum acts also as a sudorific and softens the body when used with oil as a liniment. The Chalastraean variety is used in bread-making, to replace salt; the Egyptian in cooking radishes. It renders them more tender, while it disimproves fish and flesh and bleaches them, and gives vegetables a greener colour.

LIBER XXXIII.

PROOEM. Sect. 1. **1.** Metalla nunc ipsæque opes et rerum pretia dicentur, tellurem intus exquirente cura multiplici modo. Quippe alibi divitiis foditur, quærente vita aurum, argentum, electrum, æs, alibi deliciis gemmas et parietum digitorumque pigmenta, alibi temeritati ferrum, auro etiam gratius inter bella cædesque. Persequimur omnes eius fibras vivimusque super excavatam, mirantes dehiscere aliquando aut intremiscere illam, ceu vero non hoc indignatione*s* sacræ parentis exprimi possi*nt*. **2.** Imus in viscera et in sede manium opes quærimus, tamquam parum benigna fertilique, quaqua calcatur. Et inter hæc minimum remediorum gratia scrutamur; quoto enim cuique fodiendi causa medicina est? Quamquam et hoc summa sui parte tribuit ut fruges, larga facilisque in omnibus quæcumque prosunt. **3.** Illa nos premunt, illa nos ad inferos agunt, quæ occultavit atque demersit, illa quæ non nascuntur repente, ut mens ad inane evolans reputet quæ deinde futura sit finis omnibus sæculis exhauriendi eam, quousque penetratura avaritia. Quam innocens, quam beata, immo vero etiam delicata esset vita, si nihil aliunde quam supra terras concupisceret, breviterque, nisi quod secum est!

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1. *alibi deliciis gemmas et parietum digitorumque pigmenta*, Mss. *alibi deliciis parietum digitorumque gemmas et pigmenta*, Bergk, exercitt. Plin. 2, 3. May. emends *digitorum* to *lignorum*. — *indignationes... possint*, Ed. (conj. E. H. A.) *indignatione... possit*, Mss. *indignatio*, Bergk.

2. *calcatur*, BSill. May. *secatur*, TKBrot. Dal. *caecatur*, VP. *cecatur* Rd. *secetur*, h. — *ut fruges, larga*, BSill. May. *ut sugresiarca* VR. *ut minime parca*, hDal. Brot.

3. *premunt*, VRdhDal. Brot. *perimunt*, BSill. *peremunt*, Conj. May. — *repente, ut mens*, conj. May. *ut repente mens*, BVh. *repente. Mens*, dTPSill. — *penetratura*, VRdTBrot. May. *penetratur*, BSill.

BOOK XXXIII.

INTRODUCTION. Sect. 1. **1.** Now we shall tell of metals, of the very substance of wealth, and of the prices of things, sought diligently beneath the surface of the earth in divers manners. For in some places men delve for riches, to minister to the demand for gold, silver, electrum, and copper; in other places they seek precious stones for their gratification, and colours to stain their walls and their fingers; in others still iron for deeds of violence, more acceptable even than gold in times of war and slaughter. We explore Earth's every vein, and dwell upon her hollowed frame, marvelling that she sometimes yawns or quivers, as if it were not thus only that the indignation of our sacred parent could be expressed. **2.** We penetrate into her bowels, and we seek wealth in the abode of the Dead, as though she were not sufficiently kind and fertile, where'er the foot of man is set. But least of all do we search for means of healing, for how few are inspired in their digging by the desire to cure! And yet these she has furnished on her surface in the shape of fruits, for she is a bounteous and willing giver of all things that are for our good. **3.** The things which goad us on, which drive us to the depths of Hell, are those which she has hidden deep, those which are brought to light only after long travail, so that, in flight of idle fancy, we may wonder when men at last will cease to plunder her, how far greed will penetrate. How innocent, how happy, nay more,

Sect. 2. **4.** Eruitur aurum et chrysocolla iuxta, ut pretiosior videatur nomen ex auro custodiens. Parum enim erat unam vitæ invenisse pestem, nisi in pretio esset auri etiam sanies. Quærebat argentum avaritia; boni consuluit interim invenisse minium rubentisque terræ excogitavit usum. Heu prodiga ingenia, quot modis auximus pretia rerum! Accessit ars picturæ et aurum argentumque cælando carius fecimus. Didicit homo naturam provocare, auxere et artem vitiorum irritamenta; in poculis libidines cælare iuvit ac per obscœnitates bibere. **5.** Abiecta deinde sunt hæc et sordere cœpere et auri argentique nimium fuit.

Murrina ex eadem tellure et crystallina effodimus, quibus pretium faceret ipsa fragilitas. Hoc argumentum opum, hæc vera luxuriæ gloria existimata est, habere quod posset statim perire totum. Nec hoc fuit satis. Turba gemmarum potamus et zmaragdis teximus calices, ac temulentiæ causa tenere Indiam iuvat, et aurum iam accessio est.

Cap. I. Sect. 3. **6.** Utinamque posset e vita in totum abdicari, sacrum fame ut celeberrimi auctores dixere, proscissum conviciis ab optimis quibusque et ad perniciem vitæ repertum. Quanto feliciore ævo, cum res ipsæ permutabantur inter sese, sicut et Troianis temporibus factitatum Homero credi convenit! **7.** Ita

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4. *nomen ex auro custodiens*, BPSill. May. *non natura*, l Brot. *nomen natura*, dT. *nomen naturam*, VR. — *provocare et*, BSill. *provocare, auxere et*, VRdhDal. Brot. May. — *caelare iuvit*, BdSill. May. *celebraverunt*, TBrot.

6. *sacrum fame*, Hard. May. *sacrum famae*, BSill. *sacrum fama*, VRdT. *aurum sacra fames*, hDal. *auri sacra fames*, eBrot. — *quanto*, B. *quantum*, VRdh.

7. *rebus*, Al. *rerus*, B^1. *rerum*, B^2. *merum* conj. Jan. Sillig conj. *res* but did not introduce it in text. Detlefsen and Mayhoff read *res*. — *emptitasse*, BPhSill. May. *mutasse*, drBrot. *emitasse*, T. *emittasse*, R. *aemitasse*, V.

how even luxurious would life be, if our desires did not go deeper than the surface of the earth and were satisfied, in a word, by what is within our reach!

Sect. 2. **4.** We dig up gold and with it chrysocolla, which continues to bear a name derived from gold in order that its value may appear greater. A small thing it was to have discovered one plague for humanity, but we must needs set a value even on the 'corruption of gold'. Greed sought silver, but did not fail to rejoice at having found minium, and thought out a use for this red earth.

Alas, extravagant minds, what exaggerated values we have created! The art of painting has entered the field, and we have made gold and silver dearer by engraving them. Man has learned to challenge Nature, and the encouragement of sin has added a new province even to Art. **5.** It has pleased him to engrave vicious pictures upon goblets, and to drink from these wanton scenes. Then they were despised and began to depreciate in value, gold and silver became too plentiful, and from the same earth we dug up pieces of murra and of crystal, made more precious by their perishable nature. This is considered a proof of wealth, this the very crown of luxury, to possess something that may perish utterly in the twinkling of an eye. Nor was this enough. We drink from clustering jewels and make of our cups a mosaic of emeralds. We are pleased to go all the way to India for the sake of drunkenness, and gold now serves merely as a setting.

Chap. I. Sect. 3. **6.** Would that gold could be driven utterly out of our lives, for, to quote the most famous writers, it is accursed by reason of the hunger with which it is sought, censured and reviled by all really good men, and discovered only to be a scourge to life. How much happier the age when the actual articles were exchanged for one another, as it is generally believed, on Homer's authority, was done even in the Trojan era. **7.** For in this way,

enim, ut opinor, commercia victus gratia invecta. Alios coriis boum, alios ferro captivisque rebus emptitasse tradit, quamquam et ipse, mirator auri, æstimationes rerum ita fecit ut centum boum arma aurea permutasse Glaucum diceret cum Diomedis armis novem boum. Ex qua consuetudine multa legum antiquarum pecore constat, etiam Romæ.

Sect. 4. **8.** Pessimum vitæ scelus fecit qui primus induit digitis; nec hoc quis fecerit traditur. Nam de Prometheo omnia fabulosa arbitror, quamquam illi quoque ferreum anulum dedit antiquitas, vinculumque id, non gestamen, intelligi voluit. Midæ quidem anulum, quo circumacto habentem nemo cerneret, quis non etiam fabulosiorem fateatur?

9. Manus et prorsus sinistræ maximam auctoritatem conciliavere auro, non quidem Romanæ, quarum in more ferrei erant, et virtutis bellicæ insigne. De regibus Romanis non facile dixerim. Nullum habet Romuli in Capitolio statua, nec præter Numæ Serviique Tullii alia, ac ne L. quidem Bruti. Hoc in Tarquiniis maxime miror, quorum e Græcia fuit origo, unde hic anulorum usus venit, quamquam etiam nunc Lacedæmone ferreo utuntur. **10.** Sed a Prisco Tarquinio omnium primo filium, cum in prætextæ annis occidisset hostem, bulla aurea donatum constat, unde mos bullæ duravit, ut eorum qui equo meruissent filii insigne id haberent, ceteri lorum; et ideo miror Tarquinii eius statuam sine anulo esse. Quamquam et de nomine ipso ambigi video; Græci a digitis appellavere, apud nos prisci ungulum vocabant, postea et Græci

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— *quamquam et ipse mirator auri*, Mss. *qua quamquam ipse iam mirator auri pec:*, B^1, *pec:* being erased by later hand. *et, quamquam ipse iam mirator auri, pecore*, conj. Bergk. *quare, quamquam ipse iam mirator auri, pecore*, conj. May.

9. *in more*, BVRTde. *more*, hilrDal. *mere*, conj. Gron. — *ferrei erant*, BSill. May. *ferreum id erat*, iBrot. *ferreum erat*, d. — *et*, BVRd. *ut*, iBrot.

I imagine, men began to trade in order to obtain the necessaries of life. He relates that some paid for their goods with skins of oxen and others with iron and booty. Yet even he was an admirer of gold, and such was his scale of values that he tells how Glaucus exchanged golden armour, worth a hundred oxen, for the arms of Diomede which were worth nine oxen. As a result of this system, the fine in early legislature was fixed in terms of cattle, even at Rome.

Sect. 4. **8.** The man who first set gold upon the fingers was the greatest evil-doer of history, but his name is not recorded. For I consider all the stories about Prometheus legendary, and by the iron ring which ancient authorities attributed to him also, they meant us to understand a fetter, not an ornament. And who would not admit that the ring of Midas, the turning of which rendered the possessor invisible, was still less historical!

9. Hands, aye, left or sinister hands, won gold its proud position, though not those of Romans, whose rings were customarily of iron and a mark of military prowess. I cannot speak without hesitation about the kings of Rome. The statue of Romulus on the Capitol has no ring, nor has any other except those of Numa and Servius Tullius, not even that of Lucius Brutus. This surprises me particularly in the case of the Tarquins, who came from Greece where this practice of wearing rings originated, though even now iron rings are in use at Lacedæmon. **10.** Yet it is generally admitted that the son of Tarquinius Priscus was the very first to be presented by his father with a golden *bulla*, when he had slain an enemy while still a youth (from this beginning the custom of wearing the *bulla* continued, so that the sons of those who had served in the cavalry wore this decoration, while others wore the *lorum*, and so I am surprised that the statue of that Tarquin has no ring. Yet I observe that there are differences even about the very name (for a ring). The Greeks gave it a name derived from the word for finger, our ancestors called it *ungulus*, and later on both the Greeks and ourselves called it *symbolus*.

et nostri symbolum. **11.** Longo certe tempore ne senatum quidem Romanum habuisse aureos manifestum est, siquidem iis tantum qui legati ad exteras gentes ituri essent anuli publice dabantur, credo, quoniam ita exterorum honoratissimi intellegebantur. Neque aliis uti mos fuit quam qui ex ea causa publice accepissent volgoque sic triumphabant.

Et cum corona ex auro Etrusca sustineretur a tergo, anulus tamen in digito ferreus erat æque triumphantis et servi † fortasse † coronam sustinentis. **12.** Sic triumphavit de Jugurtha C. Marius aureumque non ante tertium consulatum sumpsisse traditur. Hi quoque qui ob legationem acceperant aureos, in publico tantum utebantur his, intra domos vero ferreis, quo argumento etiam nunc sponsæ muneri ferreus anulus mittitur, isque sine gemma.

Equidem nec Iliacis temporibus ullos fuisse anulos video; nusquam certe Homerus dicit, cum et codicillos missitatos epistolarum gratia indicet et conditas arcis vestes ac vasa aurea argenteaque, et ea colligata nodi, non anuli nota.

13. Sortiri quoque contra provocationem duces non anulis tradit, fabricæ etiam deum fibulas et alia muliebris cultus sicut inaures in primordio factitasse, sine mentione anulorum. Et quisquis primus instituit, cunctanter id fecit; lævis manibus latentibusque induit, cum, si honos securus fuisset, dextra fuerit ostentandus. Quodsi impedimentum potuit in eo aliquod intellegi, etiam serioris usus argumentum est maius in læva fuisse qua scutum capitur. Est quidem apud eundem Homerum virorum

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11. *aeque*, BVhilSill. May. *eque*, d. *aequi*, R. *aequa fortuna*, eBrot. — *fortasse*, BVdhil. *feriasse*, R. Omitted by r and Brot. Mayhoff conj. *prae se* on the ground that Pliny always uses *fortassis* instead of *fortasse*.

12. *muneri*, VRdiTBrot. *muneris vice*, BSill. May. — *ea colligata*, hilDal. Brot. *eas colligatas*, BVRdTSill. May. — *nodi, non anuli, nota*, Al. Sill. May. *nodi, non anuli, notas*, B. *nodo, non anulo notata*, K.

13. *provocationem*, Al. *provocationes*, BSill. May. — *fabricae*, BVRhSill. May. *fabrice*, il. *fabricare*, dT. *fabricam*, Dal. Brot. — *serioris*, BdBrot. May. *serior is*, Sill. *sertoris*, VRTP. *sartoris*, ilr. *in sertorii*, h. *armorum*, Gron. — *argumentum est*, Mss. *argumentum esset*, Conj. May. — *maius in laeva fuisse*, Al. *et maius in laeva fuisset*, BSill. *maius in laeva fuisset*, May. — *sed ego*, conj. Ed. *ideo*, Mss.

11. It is certainly clear that, for a long time, not even the Roman senate had gold rings, since rings were given at the public expense only to those who were going as ambassadors to foreign countries, because, I imagine, they had information that the most distinguished among other races wore them. Only those were wont to wear them who had received them at the public expense for this purpose, and this rule was always observed by triumphing generals. Though an Etruscan crown of gold was borne behind him, yet there was, upon the finger alike of him who triumphed and of the slave who bore the crown, a ring of iron. **12.** Thus did C. Marius triumph over Jugurtha, and he is said not to have assumed the gold ring before his third consulship. Those, too, who had received gold rings by virtue of their office as ambassadors, only wore them on public occasions; in private they wore iron ones. And so even now an iron ring, without so much as a stone, is sent as a betrothal gift.

Indeed, I observe that there were no rings at the time of the siege of Troy. Homer certainly mentions them nowhere, though he tells that writing-tablets were sent as letters, and that garments and vessels of gold and silver were stored in chests, and that they were secured and marked with a knot instead of a ring. **13.** He relates also that the chieftains did not draw lots with rings to decide who should take up a challenge, and that the god of the workshop in the very beginning made brooches and other articles, such as ear-rings, for women's adornment, but there is no mention of rings. Whoever first introduced them did so hesitatingly, and put them on the left hand which was hidden from view, whereas, if their reception had been assured, they would have

crinibus aurum implexum; *sed ego* nescio an prior usus a feminis cœperit.

Sect. 5. **14.** Romæ ne fuit quidem aurum nisi admodum exiguum longo tempore. Certe cum a Gallis capta urbe pax emeretur, non plus quam mille pondo effici potuere. Nec ignoro MM pondo auri perisse Pompeii III cos. e Capitolini Jovis solio, a Camillo ibi condita, et ideo a plerisque existimari MM pondo collata; sed quod accessit, ex Gallorum præda fuit detractumque ab iis in parte captæ urbis delubris. **15.** Gallos cum auro pugnare solitos Torquatus indicio est. Apparet ergo Gallorum templorumque tantundem nec amplius fuisse, quod quidem in augurio intellectum est, cum Capitolinus duplum reddidisset. Illud quoque obiter indicari convenit, quoniam de anulis sermonem repetivimus, æedituum custodiæ eius comprehensum, fracta in ore anuli gemma, statim expirasse et indicium ita exstinctum. **16.** Ergo *vel* maxime MM tantum pondo, cum capta est Roma anno CCCLXIIII, fuere, cum iam capitum liberorum censa essent $\overline{\text{CLII}}$DLXXIII; *in* eadem post annos CCCVII, quod ex Capitolinæ ædis incendio ceterisque omnibus delubris C. Marius filius Præneste detulerat, $\overline{\text{XIIII}}$ pondo, quæ sub eo titulo in triumpho transtulit Sulla, et argenti $\overline{\text{VI}}$.

Idem ex reliqua omni victoria pridie transtulerat auri pondo $\overline{\text{XV}}$, argenti pondo $\overline{\text{CXV}}$.

Sect. 6. **17.** Frequentior autem usus anulorum non ante Cn. Flavium Anni filium deprehenditur. Hic namque publicatis diebus fastis, quos populus a paucis principum cotidie petebat,

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14. *effici potuere,* BhSill. May. *solvere potuere,* ilr. *potuere,* VRdTPBrot. — *nec ignoro,* BVRdTSill. May. *nec ignoro M. Crassum,* ehilrPBrot. — *perisse,* BVRSill. May. *rapuisse suo et,* hilr.

15. *quoniam,* Al. Sill. *etiam,* BUrlichs, May.

16. *vel maxime,* Ed. (conj. L. C. P.) *ut maxime,* Mss. — *in,* conj. Gelen. Omit. Mss. — $\overline{\text{XIIII}}$, BSill. May. $\overline{\text{XIII}}$ or *tredecim millia,* Al.

17. *Anni,* BSill. May. *Annii,* Al. — *plebei,* B¹Sill. May. *plebi,* VR. *plebis,* B²dhilDal. Brot.

been exhibited on the right hand. But if it is suggested that this would have hampered movement, this is but an argument for later introduction, since (in earlier times) a ring would have been a greater impediment on the left hand, which carried the shield. In Homer, too, we find that gold was bound into men's hair, but I am inclined to think that women first set the fashion.

Sect. 5. **14.** The quantity of gold at Rome was for a long time quite small. Certainly, when peace was purchased from the Gauls after the capture of the city, not more than a thousand pounds weight could be produced. I am aware that two thousand pounds of gold, which had been deposited by Camillus at the throne of Capitoline Jupiter, disappeared from there in the third consulship of Pompey, for which reason many think that two thousand pounds were collected; but the additional thousand was booty taken from the Gauls and had been stolen from shrines in the captured part of the city. **15.** (Torquatus is our evidence that the Gauls used to wear gold in battle.) It is therefore clear that the amounts of the Gallic ransom and of the temple booty were equal, and that there was no more. That indeed was the meaning of the prophecy, since Capitoline Jupiter restored twofold. This, too, we should mention in passing, since we have come back to the subject of rings, that the temple-keeper who was in charge of the booty, when arrested, broke the stone of his ring between his teeth, and died on the spot, thus destroying the evidence. **16.** Therefore, there were at most only two thousand pounds of gold when Rome was captured in the three hundred and sixty-fourth year of the city, although the number of citizens already reached one hundred and fifty-two thousand, five hundred and seventy-three.

In the Rome of three hundred and seven years later, the amount that C. Marius the younger had carried off to Praeneste, from the blazing Temple of the Capitol and all the other shrines,

tantam gratiam plebei adeptus est — libertino patre alioqui genitus et ipse scriba Appi Cæci, cuius hortatu exceperat eos dies consultando adsidue sagaci ingenio promulgaratque — ut ædilis curulis crearetur cum Q. Anicio Prænestino, qui paucis ante annis hostis fuisset, præteritis C. Pœtelio et Domitio, quorum patres consules fuerant. **18.** Additum Flavio, ut simul et tribunus plebei esset, quo facto tanta indignatio exarsit ut "anulos abiectos" in antiquissimis reperiatur annalibus. Fallit plerosque, quod tum et equestrem ordinem id fecisse arbitrantur; etenim adiectum hoc quoque, " sed et phalera posita, " propter quæ nomen equitum adiectum est.

Anulos quoque depositos a nobilitate in annales relatum est, non a senatu universo. **19.** Hoc actum P. Sempronio P. Sulpicio consulibus. Flavius vovit ædem Concordiæ, si populo reconciliasset ordines, et cum ad id pecunia publice non decerneretur, ex multatitia fæneratoribus condemnatis ædiculam æream fecit in Græcostasi, quæ tunc supra comitium erat, inciditque in tabella ærea factam eam aedem CCIII annis post Capitolinam dedicatam.

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18. *tanta indignatio*, BSill. May. *tanta indignatione*, VRd. *tanta senatus indignatione*, hilDal. Brot. — *abiectos*, BVSill. May. *abiectos fuisse*, Rd. *ab eo abiectos fuisse*, hilDal, Brot. — *etenim*, Al. Brot. May. *est enim*, Dal. *ut enim*, BSill. — *phalera posita*, VRdhDal. Brot. *phaleras positas*, BSill. May. *phalerae positae*, r. *fallera posita*, P. *fallere proposito*, l. — *propter quae*, BVSill. *propterque*, dhMay. *propter*, P. *propter quas*, K. *proptereaque*, l. *praeterque*, conj. Müller. — *est. Anulos*. Sill. and May. read *est, anulos*. — *quoque*, Mss. *que*, conj. Müller, May.

19. *publice*, BVRSill. May. *publica*, dhilDal. Brot. — *CCIII*, BSill. May. *CCIV*, Hard. Brot. *CCCIIII*, VRTdhilr.

was fourteen thousand pounds, which Sulla bore in his triumph (with an inscription to this effect) together with six thousand pounds of silver. On the previous day he had borne fifteen thousand pounds of gold and a hundred and fifteen thousand pounds of silver, acquired in all the other victories of the war.

Sect. 6. **17.** We find, however, no proof before the time of Cn. Flavius, son of Annus, that rings were commonly used. By making known the *dies fasti*, which the common folk used to find out day by day from a few of the nobles, he won so great favour with the populace that he was elected curule ædile. His father was a freedman and he himself had been secretary to Appius Cæcus, whose encouragement had spurred him on to make a list of the *dies fasti* by the continual application of his natural shrewdness, and to publish them.

His colleague was Q. Anicius Praenestinus, who had been an enemy a few years before, and the rejected candidates were C. Poetelius and Domitius, who were sons of consuls.

18. Flavius had the additional advantage of being simultaneously a tribune of the people, and this caused such a blaze of indignation that we find in the earliest annals that " rings were discarded ". Many make the mistake of thinking that the knights at this time did likewise, for these words follow, " but the phalera were also laid aside, " and so the name of the knights is introduced into the account. Again, we find in the annals that it was by the nobles, and not by the senate as a body, that rings were discarded. **19.** This took place in the consulship of P. Sempronius and P. Sulpicius.

Flavius vowed that, if he reconciled the upper classes to the common folk, he would set up a temple to Concordia, and, when money from the state exchequer was not voted for that purpose, he erected a bronze shrine in the Graecostasis, which then stood

20. I*d* a. CCCCXLVIIII a condita urbe gestum est et primum anulorum vestigium exstat, promiscui autem usus alterum secundo Punico bello; neque enim aliter potuissent trimodia anulorum illa Carthaginem ab Hannibale mitti. Inter Cæpionem quoque et Drusum ex anulo in auctione venali inimicitiæ cœpere, unde origo socialis belli et exitia rerum. **21.** Ne tum quidem omnes senatores habuerunt, utpote cum memoria avorum multi prætura quoque functi in ferreo consenuerint - sicut Calpurnium et Manilium, qui legatus Caii Marii fuerit Iugurthino bello, Fenestella tradit, et multi L. Fufidium illum, ad quem Scaurus de vita sua scripsit - in Quintiorum vero familia aurum ne feminas quidem habere mos fuerit nullosque omnino maior pars gentium hominumque, etiam qui sub imperio nostro degunt, hodie habeat. **22.** Non signat Oriens aut Ægyptus etiam nunc, litteris contenta solis. Multis hoc modis, ut cetera omnia, luxuria variavit gemmas addendo exquisiti fulgoris censuque opimo digitos onerando, sicut dicemus in gemmarum volumine, mox et effigies varias cælando, ut alibi ars, alibi materia esset in pretio. Alias deinde gemmas violari nefas putavit ac, ne quis signandi causam in anulis esse intellegeret, solidas induit. **23.** Quasdem vero neque ab ea parte qua digito occultantur auro clusit aurumque milibus lapillorum vilius fecit. Contra vero multi nullas admittunt gemmas auroque

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20. *id a.* (i.e. *anno*) conj. Müller, May. *ita*, Mss.

23. *qua*, B^1. lSill. May. *quae*, BVRdhiDal. Brot. — *occultantur*, BRdlSill. May. *occultatur*, VhiDal. Brot. — *milibus*, Mss. Sill. *mollibus*, K. *micis*, conj. Gron. *millis*, conj. Jan. May. *vilibus*, conj. Urlichs.

above the Comitium, from the fines of moneylenders who had been condemned, and he made an inscription on a brazen tablet that the shrine had been built and dedicated two hundred and three years after the Capitoline Temple. **20.** This took place in the four hundred and forty ninth year of the city and is the first record we possess of the use of rings: the next, in the second Punic War, indicates that they were in general use, for otherwise Hannibal could not have sent those three modia of rings to Carthage. Again, a ring for sale at an auction began the enmity between Caepio and Drusus, which resulted in the Social War and the devastation of the state.

21. Not even then had all the senators gold rings, for, within the memory of our grandfathers, many, even of those who had held the praetorship, grew old wearing the iron ring, among them (according to Fenestella) Calpurnius and Manilius, who was second-in-command to C. Marius in the war against Jugurtha.

Many say the same of that L. Fufidius, to whom Scaurus dedicated his autobiography. Indeed, in the family of the Quintii, it was not customary for even the women to wear gold, and at the present day the majority of nations and people, even those who dwell beneath our rule, have no rings at all. To this day Egypt and the East use no signet-rings, being satisfied with the written word alone.

22. Luxury introduced many variations in this, as in everything else, by the addition of precious stones of coveted splendour, loading the fingers with a rich man's fortune, as we shall relate in the book about gems, and later, by engraving divers figures, so that the value lay, now in the craftsmanship, now in the material. At another time, it was thought sacrilege to spoil the stones, and they were worn uncut, lest it should be imagined that the purpose of rings was to seal.

23. Certain jewels indeed luxury has left uncovered by gold even on the inside where they are hidden by the finger, and has made gold of less account than thousands of tiny stones.

ipso signant; id Claudii Cæsaris principatu repertum. Nec non et servitia iam ferrum auro cingunt, — alia per sese mero auro decorant — cuius licentiæ origo nomine ipso in Samothrace id institutum declarat.

24. Singulis primo digitis geri mos fuerat, qui sunt minimis proximi; sic in Numæ et Servii Tullii statuis videmus; postea pollici proximo induere, etiam deorum simulacris; dein iuvit et minimo dare. Galliæ Britanniæque medio dicuntur usæ. Hic nunc solus excipitur, ceteri omnes onerantur, atque etiam privatim articuli minoribus aliis. Sunt qui uni minimo congerant, alii vero et huic unum tantum, quo signantem signent. **25.** Conditus ille ut res rara et iniuria usus indigna velut e sacrario promitur, et unum in minimo digito habuisse pretiosioris in recondito supellectilis ostentatio est. Iam alii pondera eorum ostentant, aliis plures quam unum gestare labor est; alii bratteas infarcire leviore materia, propter casum, tutius gemmarum sollicitudini putant; alii sub gemmis venena cludunt, sicut Demosthenes summus Græciæ orator, anulosque mortis gratia habent. Denique ut plurima opum scelera anulis fiunt! **26.** Quæ fuit illa vita priscorum, qualis innocentia, in qua nihil signabatur! At nunc cibi quoque ac potus anulo vindicantur a rapina. Hoc profecere mancipiorum legiones, in domo turba externa ac iam servorum quoque causa nomenclator adhibendus. Aliter apud antiquos singuli Marcipores Luciporesve, dominorum gentiles, omnem victum in promiscuo habebant, nec ulla domi a domesticis custodia

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24. *uni minimo*, Al. Sill. *tres uni minimo*, hDal. Brot. *uni tantum minimo*, BMay.

25. *ut*, Mss. *vel*, Bergk. May. — *plurima*, BSill. May. *plurimum*, Al.

26. *vita priscorum*, BMay. *priscorum vita*, hDal. Brot. *vita*, Al. Sill. — *ac iam*, BSill. May. *acta*, VRdhilr.

On the other hand, many permit no stones, and seal with the gold itself, a way which became fashionable when Claudius Cæsar was emperor. Even the slaves now put a band of gold round the iron (other parts of their person they adorn at will with pure gold), an extravagance which proclaims by its very name that it originated in Samothrace.

24. At first, it was customary to wear rings on one finger only, the finger next the little one; this is what we see in the statues of Numa and Servius Tullius. Later, they were put on the finger next the thumb, even in the images of the gods. Later still, it has been fashionable to wear them on the little finger as well. The inhabitants of Gaul and Britain are said to have worn them on the second finger — the only one now left free, for all the rest are laden and even the individual joints are encumbered with other smaller rings. Some pile rings on the little finger alone, but others wear on it one ring only, to set a seal on the signet-ring. **25.** This signet-ring is treasured away as something rare and not to be insulted by being used, and is brought forth as if from a sanctuary. To wear one ring only on the little finger is a way of boasting of more precious property hidden away.

In these days, some make a parade of the weight of their rings, while others find it a burden to wear more than one, and others still, anxious for the stones, think it safer to fill a shell of gold with some lighter material, for fear of a fall. Others, like Demosthenes, the greatest orator of Greece, hide poison beneath the stones, and wear rings for this deadly purpose. In a word, how very many of the crimes of riches are done by means of rings !

26. How blessed the life of our ancestors, how great their integrity, when nothing had to be sealed ! Now even food and drink are protected from robbers by the ring. This is the good we have got from our legions of slaves, a crowd of foreigners in our homes, with the *nomenclator* whom we must now have at our call to tell us the names of the slaves.

Not so among our forefathers, when single Marcipores or Luci-

opus erat. **27.** Nunc rapiendæ comparantur epulæ pariterque qui rapiant eas, et claves quoque ipsas signasse non est satis. Gravatis somno aut morientibus anuli detrahuntur maiorque vitæ ratio circa hoc instrumentum esse cœpit, incertum a quo tempore. Videmur tamen posse in externis auctoritatem eius rei intellegere circa Polycraten Sami tyrannum, cui dilectus ille anulus in mare abiectus capto relatus est pisce, ipso circiter CCXXX urbis nostræ annum interfecto. **28.** Celebratior quidem usus cum fænore cœpisse debet. Argumentum est consuetudo vulgi, ad sponsiones etiamnum anulo exsiliente, tracta ab eo tempore quo nondum erat arra velocior, ut plane adfirmare possimus nummos ante apud nos, mox anulos cœpisse. De nummis paulo post dicetur.

Sect. 7. **29.** Anuli distinxere alterum ordinem a plebe, ut semel cœperant esse celebres, sicut tunica ab anulis senatum, quamquam et hoc sero, vulgoque purpura latiore tunicæ usos invenimus etiam præcones, sicut patrem Lucii Ælii Stilonis, Præconini ob id cognominati. Sed anuli plane tertium ordinem mediumque plebei et patribus inseruere, ac quod antea militares equi nomen dederant, hoc nunc pecuniæ indices tribuunt. **30.** Nec pridem id factum. Divo Augusto decurias ordinante maior pars iudicum in ferreo anulo fuit, iique non equites sed iudices vocabantur. Equitum nomen subsistebat in turmis equorum publicorum. Iudicum quoque non nisi quattuor decuriæ fuere primo vixque singula milia in decuriis inventa sunt, nondum provinciis ad hoc munus admissis, servatumque in hodiernum est, ne quis e novis civibus in iis iudicaret.

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29. *tertium ordinem mediumque*, BVRdTSill. May. *medium ordinem tertiumque*, hDal. Brot. *tertium ordinem medium*, conj. Bergk. *medio ordini tertium*, *plebem patribus*, conj. Desaint Ed. — *plebei*, BSill. May. *plebi*, Al. — *indices*, BViLipsius (mil. Rom. 1, 5), Sill. May. *iudices*, RdhlDal. Brot.

pores, taking their names from their masters, had all their meals at the same table as them, and there was no need to protect the house against its own servants. **27.** Now we buy banquets to be stolen and men to steal them, and to have set one's seal even on the very keys is not enough. Rings are stolen from the slumbering and the dying, and for countless years most of the operations of life have come to centre round this piece of property. Yet I think we can understand its importance abroad in the time of Polycrates, tyrant of Samos, owner of that choice ring which, though cast into the sea, was restored after the capture of the fish. He was put to death about the two hundred and thirtieth year of the city.

28. The use of rings must have begun to spread with the introduction of usury. This is proved by the custom of the common people (for rings leap out even now to make bargains), derived from the time when no speedier earnest existed. The obvious conclusion is that money was introduced among us shortly before rings. Money we will discuss a little later.

Sect. 7. **29.** Since they began to be commonly worn, rings have come to distinguish the second order from the Plebs, just as the tunic has distinguished the senate from the ring-wearing order. Yet this too is of recent date, and we find frequent references to the fact that the tunic with the broader purple stripe was worn also by heralds, like the father of Lucius Aelius Stilo, who was surnamed Præconinus by reason of his office.

Rings marked clearly the admission of a third order, intermediate between the plebs and the fathers, and the name [*equites*], which was originally derived from their chargers, is now due to these badges of wealth. **30.** This has not long been so. When the Emperor Augustus regulated the decuries, the majority of the Judices wore iron rings, and they were called, not Equites, but Judices. The name of Equites was still the property of the squadrons with horses furnished by the State. Of the Judices, too, there were at first only four decuries, each numbering scarce a thousand, for provincials were not yet allowed to perform these functions, and it is still the rule that no new citizen should be a Judex.

Cap. II. **31.** Decuriæ quoque ipsæ pluribus discretæ nominibus fuere, tribunorum æris et selectorum iudicum. Præter hos etiamnum nongenti vocabantur, ex omnibus electi ad custodiendas suffragiorum cistas in comitiis. Et divisus hic quoque ordo erat superba usurpatione nominum, cum alius se nongentum, alius selectum, alius tribunum appellaret.

Sect. 8. **32.** Tiberii demum principatus nono anno in unitatem venit equester ordo, anulorumque auctoritati forma constituta est, C. Asinio Pollione, C. Antistio Vetere coss. anno urbis conditæ DCCLXXV., quod miremur, futili pæne de causa, cum C. Sulpicius Galba, iuvenalem famam apud principem popinarum pœnis aucupatus, questus esset in senatu vulgo institores eius culpæ defendi anulis. Hac de causa constitutum ne cui ius esset, nisi qui ingenuus ipse patre, avo paterno, HS $\overline{\text{CCCC}}$ census fuisset, et lege Iulia theatrali in XIV ordinibus sedisset. Postea gregatim insigne id adpeti cœptum. **33.** Propter hæc discrimina Gaius princeps decuriam quintam adiecit, tantumque enatum est fastus ut quæ sub divo Augusto impleri non potuerant decuriæ, non capiant eum ordinem passimque ad ornamenta ea etiam servitute liberati transiliant, quod antea nunquam erat factum, quoniam in ferreo anulo et equites iudicesque intellegebantur ; adeoque promiscuum id esse cœpit ut apud Claudium Cæsarem in censura eius unus ex equitibus, Flavius Proculus, quadringentos ex ea causa reos postularet. Ita, dum separatur ordo ab ingenuis, communi-

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31. *selectorum*, dhSill. May. *sectorum*, B. *setecorum*, R. *setecos*, V. omitted, il. — *iudicum*, Ed. (conj. L. C. P.) *et iudicum*, Mss.

32. *cui ius*, dhSill. May. *cuius*, B. *cui ius id*, RPDal. Brot. *cui id*, V. — *qui ingenuus ipse*, BSill. May. *cui ingenuo ipsi*, hDal. Brot. *cui ingenuo*, PVRdl. — *patre*, BSill. May. *patri*, VRdhilPDal. Brot. — *sedisset*, BSill. May. *sedendi*, VRdhilDal, Brot.

33. *et equites*, BVRTSill. May. *equites*, dhilDal. Brot.

Chap. II. **31.** These decuries had several divisions with names of their own — the *tribuni æris* and the *selecti iudices.* Besides these, moreover, certain of them, who were chosen from their number to keep the ballot-boxes at elections, were called ‘ The Nine Hundred ’, and the proud assumption of the various names caused divisions in this order also, for one styled himself ‘ one of the Nine Hundred ’, another a *selectus*, and another a *tribunus.*

Sect. 8. **32.** Finally, in the ninth year of the reign of Tiberius, the equestrian order was unified, and conditions were laid down to regulate the wearing of rings in the consulship of C. Asinius Pollio and C. Antistius Vetus, in the seven hundred and seventy fifth year of the city. Strange to say, the cause of this was almost frivolous, for C. Sulpicius Galba, who was seeking, while still young, to win a reputation with the Emperor by prosecuting proprietors of eating-houses, complained in the Senate that those who trafficked in that breach of the law were defending themselves by their rings.

And so it was decreed that none should have the right of wearing a ring save he who, being himself a free man by virtue of his father and his paternal grandfather, was assessed at 400,000 sesterces, and sat in the fourteen rows in accordance with the Lex Julia Theatralis. Later, people began to seek this badge of rank in shoals. **33.** On account of these discriminatory conditions, the Emperor Gaius added a fifth decury, and to such a pitch has insolence risen that the decuries, whose cadres could not be filled in the reign of the Emperor Augustus, cannot now accommodate that order, and on all sides even those fresh from slavery have, at a bound, assumed its insignia. This never used to happen, for the wearing of the iron ring used to stamp its wearer as an Eques and a Judex. And so often did this occur that, in the censorship of the Emperor Claudius, Flavius Proculus, a knight, impeached four hundred people before the Emperor on this charge. So, while the equites are set apart from other freeborn citizens,

catus est cum servitiis. **34.** Iudicum autem appellatione separare eum ordinem primi omnium instituere Gracchi discordi popularitate in contumeliam senatus; mox debellata auctoritas nominis vario seditionum eventu circa publicanos substitit, et aliquamdiu tertiæ sortis viri publicani fuere. Marcus Cicero demum stabilivit equestre nomen in consulatu suo Catilinianis rebus, ex eo ordini profectum se celebrans eiusque vires peculiari popularitate quærens. Ab illo tempore plane hoc tertium corpus in re publica factum est cœpitque adici 'senatui populoque Romano' 'et equester ordo'. Qua de causa et nunc post populum scribitur, quia novissime cœptus est adici.

Sect. 9. **35.** Equitum quidem etiam nomen ipsum sæpe variatum est, in iis quoque qui id ab equitatu trahebant. Celeres sub Romulo regibusque sunt appellati, deinde flexuntes, postea trossuli, cum oppidum in Tuscis citra Volsinios p. $\overline{\text{VIIII}}$ sine ullo peditum adiumento cepissent eius vocabuli; idque duravit ultra C. Gracchum. **36.** Junius certe, qui ab amicitia eius Gracchanus appellatus est, scriptum reliquit his verbis — "Quod ad equestrem ordinem attinet, antea trossulos vocabant, nunc equites vocant ideo, quia non intellegunt trossulos nomen quid valeat multosque pudet eo nomine appellari," et causam quæ supra indicata est exponit invitosque etiamnum tamen trossulos vocari.

Sect. 10. **37.** Sunt adhuc aliquæ non omittendæ in auro differentiæ. Auxilia quippe et externos torquibus aureis donavere, at cives non nisi argenteis, præterque armillas civibus dedere, quas non dabant externis.

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34. *sortis viri*, BSill. May. *vires*, RdhilPDal. Brot.

35. *qui id*, BTSill. May. *qui*, PRdhilDal. Brot. *quid*, V. — *ab equitatu*, BSill. May. *ad equitatum*, VRPdhilDal. Brot. *ad aequitatem*, T. — *flexuntes*, BSill. May. *flexumentes*, VRdT. *flexumenti*, il. *flexumines*, hDal. Brot. *flexutes*, conj. Salmas. from note by Servius on Virg. Aen. 9, 606. *floxumines*, conj. Desaint Ed.

37. *dabant externis*, BSill. May. *habent externi*, VdhilPDal. Brot. *habent externis*, R.

they have come to be associated with the slaves. **34.** The Gracchi were the first to give to the Judices their distinctive title, in their attempts to win popularity by stirring up strife, and to humiliate the senate. Soon the Publicani became the representatives of a name whose authority had been extinguished by the vicissitudes of civil disturbance, and these Publicani were long a sort of " third estate ". At length, as a result of the Catiline conspiracy during his consulship, Marcus Cicero set the equestrian name on a sure foundation, making it his boast that he was of equestrian origin, and seeking the support of the knights by acts that promoted his personal popularity. From that time they became openly acknowledged as the third body in the state, and to the words *Senatus populusque Romanus* began to be added *et equester ordo*. That is why it is even now written after *populus*, because it was the last to be added.

Sect. 9. **35.** Departures from the name Equites itself were common, even among those who derived it from their possession of a horse. They called themselves *celeres* under Romulus and the kings, then *flexuntes*, and *trossuli* at a still later date, when, without any help from the infantry, they had captured a town thus named in Etruria, nine miles nearer Rome than Volsinii, and this practice continued till after the time of Caius Gracchus. **36.** In fact, the following passage occurs in the writings of Junius, who was called Gracchanus from his friendship with Gracchus :— " As regards the equestrian order, they were formerly called *trossuli*, but are now called *equites* because they do not understand the worth of the name *trossuli*, and many are ashamed to be called by it ". Then he sets forth the reason given above, and remarks that even now they are still called *trossuli* against their will.

Sect. 10. **37.** A few points of distinction in the use of gold remain to be mentioned. Collars of gold were given to auxiliaries and foreign soldiers, of silver to citizens.

Sect. 11. **38.** Iidem, quo magis miremur, coronas ex auro dedere et civibus. Quis primus donatus sit ea, non inveni equidem; quis primus donaverit, a L. Pisone traditur. A. Postumius dictator, apud lacum Regillum castris Latinorum expugnatis, ei cuius maxime opera capta essent, hanc coronam ex præda dedit l.; item L. Lentulus cos. Servio Cornelio Merendæ, Samnitum oppido capto, sed huic quinque librarum. Piso Frugi filium ex privata pecunia donavit eamque coronam testamento ei prælegavit.

Cap. III. Sect. 12. **39.** Deorum honoris causa in sacris nihil aliud excogitatum est, quam ut auratis cornibus hostiæ, maiores dumtaxat, immolarentur. Sed in militia quoque in tantum adolevit hæc luxuria ut M. Bruti e Philippicis campis epistolæ reperiantur frementis fibulas tribunicias ex auro geri. Ita Hercules! Idem enim tu, Brute, mulierum pedibus aurum gestatum tacuisti, et nos sceleris arguimus illum qui primus auro dignitatem per anulos fecit! **40.** Habeant in lacertis iam quidem et viri, quod e Dardanis venit — itaque et Dardanium vocabatur, viriolæ Celtice dicuntur, viriæ Celtiberice — habeant feminæ in armillis digitisque totis, collo, auribus, spiris, discurrant catenæ circa latera et in secreto margaritarum sacculi e collo dominarum aureo pendeant, ut in somno quoque unionum conscientia adsit; etiamne pedibus

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38. *quo*, BVRdilSill. May. *quod*, hDal. Brot. — *et civibus*, BSill. May. *ex civibus*, VRdTP. *civibus*, hilDal. Brot. — *dedit l.*, B¹. *dedit*, B²hilSill. *is dedit*, RdTBrot. *his dedit*, V. *dedit librarum III*, conj. Bergk. *is dedit II l.*, conj. May. — *Piso Frugi*, Mss. *trium Piso Frugi*, conj. Urlichs, May.

40. *quidem*, BVRTPdhlSill. May. *pridem*, iDal. Brot. — *Celtice*, BTSill. May. *Celticae*, VRdhDal. Brot. — *Celtiberice*, conj. Sill. May. *Celtibericae*, BVRdhlDal. Brot. — *armillis*, see note. — *e collo*, VRPTdehDal. Brot. May. *collo*, BilSill. — *paedagogiis*, iGelen. Sill. May. *paedagogis*, BVRdhl. — *convertit*, Mss. Sill. May. *convenit*, K. *convestit*, conj. Lipsius (excurs. Tac. Ann. 15, 69). *converrit*, conj. Desaint Ed.

Again, citizens received armlets, which were never presented to foreign soldiers.

Sect. 11. **38.** The strangest thing of all is that the very men who made these distinctions gave gold crowns to citizens also. I have not been able to discover the first recipient of that honour, but the first donor is recorded by Lucius Piso. Aulus Postumius, the dictator, after the storming of the Latin camp at Lake Regillus, gave from the booty this crown of a pound weight to the man who had been most instrumental in capturing the camp. In like manner, Lucius Lentulus, when consul, gave a crown to Servius Cornelius Merenda, after the capture of a Samnite town, but in this case the crown weighed five pounds. Again, Piso Frugi presented his son with a crown from his private purse, and, in his will, made it a first charge on his estate.

Chap. III. Sect. 12. **39.** Nothing has been devised to honour the gods in their sacred rites save the gilding of the horns of the larger sacrificial victims. And yet, even on the field of battle, the extravagant use of gold grew to such a pitch that letters are extant, written by Marcus Brutus on the field of Philippi, complaining about the wearing of gold brooches by the tribunes. By Hercules, forsooth! You were the very man, Brutus, who had not a word to say against women wearing gold on their feet, while we, for our part, consider as criminal the man who first made rings the means of bringing gold into honour.

40. Let even men now wear it on their arms, a Dardanian custom (and therefore called 'Dardanium'. The Celtic name is *viriolæ*, the Celtiberian *viriæ*), let women wear it in bracelets and on every finger, round their necks, in their ears, and twisted in their hair, let gold chains wander round their waists, and let a bag of pearls hang unsuspected from my lady's gold-bedizened

induetur atque inter stolam plebemque hunc medium feminarum equestrem ordinem faciet? Honestius viri pædagogiis id damus balineasque dives puerorum forma convertit. **41.** Iam vero et Harpocraten statuasque Ægyptiorum numinum in digitis viri quoque portare incipiunt. Fuit et alia Claudii principatu differentia insolens iis quibus admissionem liberti eius dedissent, imaginem principis ex auro in anulo gerendi, magna criminum occasione; quæ omnia salutaris exortus Vespasiani imperatoris abolevit æqualiter publicando principem. De anulis aureis usuque eorum hactenus sit dictum.

Sect. 13. **42.** Proximum scelus fuit eius qui primus ex auro denarium signavit, quod et ipsum latet auctore incerto. Populus Romanus ne argento quidem signato ante Pyrrhum regem devictum usus est. Libralis — unde etiam libella dicitur et dupondius — adpendebatur assis. Quare æris gravis pœna dicta, et adhuc expensa in rationibus dicuntur, item impendia et dependere; (**43.**) quin et militum stipendia, hoc est stipis pondera, dispensatores, libripendes, qua consuetudine in iis emptionibus, quæ mancipii sunt, etiam nunc libra interponitur. Servius rex primus signavit æs; antea rudi usos Romæ Timæus tradit. Signatum est nota pecudum, unde et pecunia appellata. Maximus census $\overline{\text{CXX}}$ assium fuit illo rege et ideo hæc prima classis. **44.** Argentum signatum anno urbis CCCCLXXXV., Q. Ogulnio C. Fabio coss.,

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41. *admissionem liberti eius,* PVRdhilDal. Brot. *admissionis liberae eius,* B. *admissionum liberti ius,* conj. Lipsius (ad Tac. Ann. 6, 9). — *admissionis liberae ius,* conj. Sill. *admissiones liberae ius,* conj. Mommsen. May.

42. *fuit eius,* BSill. May. *fuit,* VR. *fecit,* dhilDal. Brot.

neck, that even in sleep she may be conscious that her pearls are near: but must the feet too be decked with gold, and is a kind of female equestrian order to be thus made between the stola-clad matron and the woman of the people! If we men bestow gold on our pages, and the adornments lavished on their boyish beauty change the appearance of our baths, 'tis at least less shameful than that.

41. Why even men are now beginning to wear Harpocrates and other Egyptian divinities graven on their finger-rings. There was another unusual departure in the reign of Claudius, that of wearing on a ring a golden figure of the Emperor. This was worn by those who had been given the entrée by his freedmen — a custom that led to many prosecutions. The benign accession of the Emperor Vespasian put an end to all this by making the head of the state accessible to all alike. So much about gold rings and their use.

Sect. 13. **42.** The next great crime was his who first coined a gold denarius, but the matter is obscure and the originator is not recorded. The Roman people, however, did not use even silver coins till after the defeat of King Pyrrhus. The as used to weigh a pound — from which 'libella' and 'dupondius', words still in use, are derived. That is why penalties are inflicted in terms of 'aes grave', and we use the words 'expensa', 'impendia', 'dependere' in our account-books; **(43.)** not to mention the 'stipendia' (that is 'weight of money') of soldiers, the 'dispensatores', and the 'libripendes'. In accordance with this latter custom, a scales is introduced even now in sales by *mancipium.* King Servius was the first to coin copper, uncoined copper being used at Rome before that time, according to Timæus. The device employed was the figure of an animal *(pecus)*, from which it was called *pecunia.* The highest figure at which any property was rated in that reign was 120,000 asses, which was therefore fixed on as the assessment for the first class.

44. Silver was coined in the four hundred and eighty fifth year of the city, in the consulship of Quintus Ogulnius and Caius

quinque annis ante primum Punicum bellum, et placuit denarium pro decem libris æris valere, quinarium pro quinque, sestertium pro dupondio ac semisse. Librale autem pondus æris imminutum est bello Punico primo, cum impensis res publica non sufficeret, constitutumque ut asses sextantario pondere ferirentur. Ita quinque partes lucri factæ dissolutumque æs alienum.

45. Nota æris eius fuit ex altera parte Ianus geminus, ex altera rostrum navis, in triente vero et quadrante rates. Quadrans antea terruncius vocatus a tribus unciis. Postea Hannibale urguente, Q. Fabio Maximo dictatore, asses unciales facti placuitque denarium sedecim assibus permutari, quinarium octonis, sestertium quaternis; ita res publica dimidium lucrata est. **46.** In militari tamen stipendio semper denarius pro decem assibus datus est. Notæ argenti fuere bigæ atque quadrigæ; inde bigati quadrigatique dicti. Mox lege Papiria semunciarii asses facti. Livius Drusus in tribunatu plebei octavam partem æris argento miscuit. Is qui nunc Victoriatus appellatur lege Clodia percussus est. Antea enim hic nummus ex Illyrico advectus mercis loco habebatur; est autem signatus Victoria et inde nomen.

47. Aureus nummus post annos LI percussus est quam argenteus,

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45. *urgente, Q.* ilSill, May. *urguente quem*, B. *urgente marcumque*, V. *urgente Marcum Q.* RdT.

47. *post annos LI*, BUrlichs, May. *post annos LXII*, Al., Sill. — *sestertiis vicenis*, dSill. *sesternis vicenis*, h. *sestertius vicenus*, Vl. *sestertiis vicenus*, R. *sestertius vicenis*, Pi. *sestertio viciens*, B. *sestertios vicenos*, Brot. Detl. May. — *effectum*, Conj. Ed. *effecit*, Mss. — *librali*, BUrlichs. *libras*, Al. Sill. *libram*, Conj. May. — *CCCC*, B. *sestertios DCCCC*, hilPSill. *D. nongenti*, VRd. *V̄DCCLX*, May. in agreement with Mommsen. — *XXL*, TVeSill. May. *XL*, Rdil. *XXXX*, B. *XL millia*, h. *XL*, *M*, Dal. — *novissime*, BVSill. May. *imminuisse*, dTP. *minutissime*, ilBrot. *minutissimus*, hDal.

Fabius, five years before the first Punic War, and the following scale of values was approved : — One denarius is equivalent to ten lbs. of copper, one quinarius is equivalent to five lbs. of copper, one sestertius is equivalent to two and a half lbs. of copper. The weight of a libra of copper, however, was reduced in the first Punic War, when the State could not meet its liabilities, and a decree was passed that asses weighing a sextans (one-sixth of a pound) should be struck. So a saving of five-sixths was effected and the debt was liquidated. **45.** The device on the obverse of this copper coinage was a two-headed Janus, that on the reverse the beak of a warship. The triens and the quadrans, on the other hand, were stamped with ships. (The quadrans was formerly called the *terruncius*, or the ‘ three-ounce ’ coin.)

Later still, when Q. Fabius Maximus was dictator, the pressure exerted by Hannibal was so great that asses weighing an ounce were struck, and it was decided to make the denarius equivalent to sixteen asses, the quinarius to eight asses and the sestertius to four. In this way the State benefited by one-half. **46.** For all that, in paying the troops the denarius has always been given as the equivalent of ten asses.

The devices on silver coins were *bigæ* and *quadrigæ* (two-horsed and four-horsed chariots), whence the names *bigati* and *quadrigati.*

Later, by the Lex Papiria, asses weighing half an ounce were struck. Livius Drusus, when tribune of the people, adulterated the silver coinage with one-eighth of its weight of copper. The coin now called the Victoriatus was struck in accordance with the Lex Clodia, for before that it had been imported from Illyricum as an article of merchandise. The device, from which the name originated, was a Victory.

47. Gold coins were struck fifty-one years after silver coins,

ita ut scripulum valeret sestertiis vicenis, quod effect*um* in librali ratione sestertii qui tunc erat CCCC. Postea placuit X XL signari ex auri libris, paulatimque principes imminuere pondus, novissime Nero ad XLV.

Sect. 14. **48.** Sed a nummo prima origo avaritiæ, fœnore excogitato, quæstuosaque segnitia, nec paulatim exarsit rabie quadam non iam avaritia sed fames auri, ut pote cum Septimuleius, C. Gracchi familiaris, auro rependendum caput eius abscisum ad Opimium tulerit plumboque in os addito parricidio suo rem publicam etiam circumscripserit, nec iam Quiritium aliquis sed universo nomine Romano infami rex Mithridates Aquilio duci capto aurum in os infudit; hæc parit habendi cupido.

49. Pudet intuentem nomina ista, quæ subinde nova Græco sermone excogitantur, insperso argenteis vasis auro aut incluso, quibus deliciis pluris veneunt inaurata quam aurea, cum sciamus interdixisse castris suis Spartacum, ne quis aurum haberet aut argentum; tanto plus fuit animi fugitivis nostris.

50. Messalla orator prodidit Antonium triumvirum aureis usum vasis in omnibus obscenis desideriis, pudendo crimine etiam Cleopatræ. Summa apud exteros licentiæ fuerat Philippum regem poculo aureo pulvinis subdito dormire solitum, Hagnonem Teium Alexandri magni præfectum aureis clavis suffigere crepidas; Antonius solus contumelia naturæ vilitatem auro fecit. O dignum proscriptione, sed Spartaci!

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48. *origo*, Al. Dal. Brot. May. *origine*, BSill. — *excogitato*, B^1 Gesner (Chrestom., p. 82-1), Detl. May. *excogitata*, Al. Sill. — *abscisum*, BSill. May. *excisum*, Al. Dal. Brot.

49. *insperso*, BSill. May. *expresso*, PRilDal. Brot. *experso*, V. *expressis*, h.

50. *summa*, BSill. May. *summam*, V. *summae*, Al. — *solus*, BSill. May. *opus*, VRT. *sopus*, d. *sopius*, h. *sophos*, P. *apud nos*, Gron. Brot. — *vilitatem*, Al. Dal. Brot. May. *utilitatem*, BSill.

a scruple to be worth twenty sesterces. This was done at the current value of the sesterce, four hundred to the pound (of silver). Later it was decreed that forty denarii should be struck from the pound of gold, and little by little the Emperors decreased the weight of the denarius, Nero finally reducing them to forty-five to the pound.

Sect. 14. **48.** From money, when usury was invented, first sprang greed, and wealth acquired in idleness. No gradual process this. With a sort of frenzy there blazed forth what was soon no longer a greed, but a *hunger* for gold. Witness Septimuleius, the friend of Caius Gracchus, who brought Gracchus' severed head to Opimius to sell it for its weight in gold, and, by pouring lead into the mouth, further cheated the State in his unnatural crime. Again, it was the evil name, not of any individual citizen, but of Romans one and all, that made King Mithridates pour gold into the mouth of the captive general Aquilius. Such are the offspring of greed.

49. We feel ashamed when we see the new names, continually manfactured from Greek sources, for silver vessels filagreed or inlaid with gold. By such refinements gilded articles fetch more than gold ones, although we know that Spartacus forbade his followers to have gold or silver. So much finer was the character of our runaway slaves !

50. The orator Messalla proclaimed that the triumvir Antony used vessels of gold for all his vulgar needs, a charge which would have disgraced even Cleopatra. King Philip's habit of sleeping with a gold cup beneath his pillow, and the gold nails with which the sandals of Hagnon of Teos, prefect of Alexander the Great, were put together, had been considered instances of foreign licentiousness. Antony alone, despising all that is natural, made gold utterly despicable, and should have had to stand his trial, with Spartacus on the bench.

Sect. 15. **51.** Equidem miror populum Romanum victis gentibus in tributo semper argentum imperasse, non aurum, sicut Carthagini cum Hannibale victæ octingen*t*a milia, $\overline{\textit{XVI}}$ pondo annua in quinquaginta annos, nihil auri. Nec potest videri penuria mundi id evenisse. Iam Midas et Crœsus infinitum possederant, iam Cyrus devicta Asia pondo $\overline{\text{XXIIII}}$ invenerat præter vasa aurumque factum et in eo folia ac platanum vitemque. Qua victoria argenti $\overline{\text{D}}$ talentorum reportavit et craterem Semiramidis, cuius pondus XV talentorum colligebat; talentum Ægyptium pondo LXXX patere Varro tradit. **52.** Iam regnaverat in Colchis Saulaces Æ*e*tæ subolis qui terram virginem nactus plurimum auri argentique eruisse dicitur in Suanorum gente, et alioqui velleribus aureis incluto regno. Et illius aureæ camaræ, argenteæ trabes et columnæ atque parastaticæ narrantur, victo Sesostri Ægypti rege tam superbo ut prodatur annis quibusque sorte reges singulos e subiectis iungere ad currum solitus atque ita triumphare.

Sect. 16. **53.** Et nos fecimus quæ posteri fabulosa arbitrarentur. Cæsar, qui postea dictator fuit, primus in ædilitate, munere patris funebri, omni apparatu harenæ argenteo usus est, ferasque etiam argenteis vasis incessivere tum primum noxii, quod iam etiam in municipiis æmulantur. C. Antonius ludos scæna argentea

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51. *octingenta milia*, $\overline{\textit{XVI}}$ *pondo annua*, Conj. Jan, May. *octingena milia pondo annua*, BSill. Other mss. omit *octingena milia* for which VRdT read *aut*, hil *argenti*. — *folia ac*, Mss. Sill. *solia ac*, Pint. *solium*, Conj. May. *foliatam*, Conj. Jan.

52. *Aeetae subolis*, Sill. May. *aetaesobolis*, B. *Aeetae soboles*, Voss (ad Catull. p. 169). *aetesubopes*, V. *et Esubopes*, RdhilDal, Brot. — *victo*, Al. *victae*, hMay. — *rege*, Mss. *regi*, Conj. May.

53. *arbitrarentur*, BVRdSill. *arbitrentur*, hilPDal. Brot. May. — *vasis*, Mss. Sill. May. *gesis*, Hard. *hastis*, Gron. Brot. *verutis*, Lipsius (Poliorc. 4, 4, p. 609). — *CXXIIII*, VdhilDal. $\overline{\textit{CXXIIII}}$, BLipsius (Magnit. Rom. 2, 11, p. 726). Brot. *CXXXIIII*, R.

Sect. 15. **51.** It surprises me that the Roman people has always imposed on conquered nations a tribute, not of gold, but of silver. For example, after the conquest of Carthage and Hannibal, the tribute was eight hundred thousand pounds of silver, sixteen thousand yearly for fifty years, but no gold. This was clearly not caused by scarcity of gold in the world. Before this, Midas and Croesus had possessed gold without end, and Cyrus, when he had subdued Asia, had found twenty-four thousand pounds of it, not to speak of golden vessels and wrought gold, leaves of trees, a plane-tree, and a vine, all made of the precious metal. After this same conquest, he carried off five hundred thousand talents of silver, and the cup of Semiramis, which weighed fifteen talents. (According to Varro, the Egyptian talent is equivalent to eighty pounds weight.) **52.** Before this, too, Saulaces, son of Aeetes, king in Colchis, is said to have won a vast amount of gold and silver from his virgin land, in the country of the Suani. Famous too was his kingdom for its golden fleeces. And his the golden arches, and the beams and columns and pilasters of silver, famed in story, won by his victory over Sesostris, king of Egypt, a monarch so arrogant that he is recorded as having been wont to yoke to his car each year individual kings, chosen by lot from his vassals, and thus to drive in triumph.

Sect. 16. **53.** We too have done deeds which our descendants will scarcely credit. Caesar, who was afterwards dictator, was the first to use nothing but silver equipment in the arena, at the games in honour of his dead father, celebrated during his aedileship. Another novelty on this occasion was that the criminals attacked wild beasts with silver weapons, a freak which is now copied even in the country towns. C. Antonius presented games on a stage of silver, and so did L. Murena. The Emperor Gaius brought

fecit, item L. Murena; Gaius princeps in circo pegma duxit, in quo fuere argenti pondo CXXIIII. **54.** Claudius successor eius cum de Britannia triumpharet, inter coronas aureas, $\overline{\text{VII}}$ pondo habere, quam contulisset Hispania citerior, $\overline{\text{VIIII}}$, quam Gallia comata, titulis indicavit. Huius deinde successor Nero Pompeii theatrum operuit auro in unum diem, quo Tiridati Armeniæ regi ostenderet. Et quota pars ea fuit aureæ domus ambientis urbem!

Sect. 17. **55.** Auri in ærario populi Romani fuere, Sex. Iulio L. Aurelio coss., septem annis ante bellum Punicum tertium, pondo $\overline{\text{XVII}}$, CCCCX, argenti $\overline{\text{XXII}}$, LXX, et in numerato $\left|\overline{\text{LXI}}\right|$, $\overline{\text{XXXV}}$, CCCC; Sex. Iulio L. Marcio coss., hoc est belli socialis initio, auri.......... $\left|\overline{\text{XVI}}\right|$, $\overline{\text{XX}}$, DCCCXXXI. **56.** C. Cæsar, primo introitu urbis civili bello suo, ex ærario protulit laterum aureorum $\overline{\text{XV}}$, argenteorum $\overline{\text{XXX}}$, et in numerato $\left|\overline{\text{CCC}}\right|$; nec fuit aliis temporibus res publica locupletior. Intulit et Æmilius Paulus, Perseo rege victo, e Macedonica præda HS CↃ CↃ CↃ, a quo tempore populus Romanus tributum pendere desiit.

Sect. 18. **57.** Laquearia, quæ nunc et in privatis domibus auro teguntur, post Carthaginem eversam primo in Capitolio inaurata sunt, censura L. Mummii. Inde transiere in camaras quoque et parietes, qui iam et ipsi tamquam vasa inaurantur, cum varia sua ætas de Catulo existimaverit, quod tegulas æreas Capitoli inaurasset.

Sect. 19. **58.** Primos inventores auri, sicut metallorum fere omnium, septimo volumine diximus. Præcipuam gratiam huic materiæ fuisse arbitror non colore, qui clarior in argento est

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54. $\overline{\mathit{VII}}$, BSill. May. *VII*, VRhilDal. *VI*, dT. — $\overline{\mathit{VIIII}}$, BSill. May. *IX*, VRdhlTDal. *XX*, i.

55. $\left|\overline{\mathit{LXI}}\right|$, $\overline{\mathit{XXXV}}$, BMay. Sill. reads $\overline{\mathit{LXI}}$, *XXXV*. — Lacuna marked after *auri* by Detlefsen, Mommsen, and Mayhoff. — $\left|\overline{\mathit{XVI}}\right|$. $\overline{\mathit{XX}}$, BMay. Sill. reads $\overline{\mathit{XVI}}$, *XX*.

56. $\left|\overline{\mathit{CCC}}\right|$, BMay. *CCC*, Al. Sill. reads $\overline{\mathit{CCC}}$.

58. *gemma*, BSill. May. *gemmis*, Al.

into the Circus a pegma, decorated with one hundred and twenty four pounds of silver. **54.** His successor Claudius, on the occasion of his triumph over Britain, displayed placards declaring that among his gold crowns he bore two, weighing seven thousand and nine thousand pounds, contributed by Hispania Citerior and Gallia Comata respectively. Then Nero, who succeeded Claudius, covered the theatre of Pompey with gold for the single day on which he was to display it to Tiridates, king of Armenia. And yet how small was that compared to the Golden House that embraced a whole city within its walls!

Sect. 17. **55.** In the consulship of Sex. Julius and L. Aurelius, seven years before the third Punic War, the Roman treasury contained 17,410 pounds of gold, 22,070 pounds of silver, and in coin 6,135,400 sesterces. When Sex. Julius and L. Marcius were consuls, that is to say at the beginning of the Social War, there was gold............1,622,831 sesterces.

56. C. Caesar, when he entered the city for the first time during the civil war that bears his name, brought forth from the treasury 15,000 gold bricks, 30,000 silver bricks, and 30,000,000 sesterces, in coin — never before nor since was the State richer. Again Aemilius Paulus, after the conquest of king Perseus, brought to Rome from booty taken in Macedonia 300,000,000 sesterces, since when the Roman people has ceased to pay taxes.

Sect. 18. **57.** Ceilings, which are now lined with gold even in private houses, were first gilded in the case of the Capitol after the overthrow of Carthage, when L. Mummius was censor. Next they turned their attention to arched roofs and walls (even these are now gilded like so many pieces of plate), though, when Catulus gilded the bronze tiles of the Capitol, the verdict of his contemporaries was by no means unanimous.

Sect. 19. **58.** The names of the first discoverers of gold (as of almost all the metals) have been given in Book Seven. I think that pride of place is given to this substance, not by reason of its

magisque diei similis, ideo militaribus signis familiarior, quoniam longius fulget, manifesto errore eorum qui colorem siderum placuisse in auro arbitrantur, cum in gemma aliisque rebus non sit præcipuus; (**59.**) nec pondere aut facilitate materiæ prælatum est ceteris metallis, cum cedat per utrumque plumbo, sed quia rerum uni nihil igne deperit, tuto etiam in incendiis rogisque. Quin immo quo sæpius arsit, proficit ad bonitatem, aurique experimentum ignis est, ut simili colore rubeat ignescatque et ipsum; obrussam vocant.

60. Primum autem bonitatis argumentum quam difficillime accendi. Præterea mirum pruna violentissimi ligni indomitum palea citissime ardescere atque, ut purgetur, cum plumbo coqui. Altera causa pretii maior, quod minimum usus deterit, cum argento, ære, plumbo lineæ præducantur manusque sordescant decidua materia. **61.** Nec aliud laxius dilatatur aut numerosius dividitur, utpote cuius unciæ in septingenas quinquagenas pluresque bratteas quaternum utroque digitorum spargantur. Crassissimæ ex iis Prænestinæ vocantur, etiamnum retinente nomen Fortunæ inaurato fidelissime ibi simulacro; proxima brattea quæstoria appellatur. Hispania striges vocat auri parvulas massas. **62.** Super omnia solum in massa aut ramento capitur, cum cetera in metallis reperta igni perficiantur; hoc statim aurum est consummatamque materiam suam protinus habet, cum ita invenitur. Hæc enim inventio eius naturalis est, alia quam dicemus coacta. Super cetera non robigo ulla, non ærugo, non aliud ex ipso quod consumat bonitatem minuatve pondus.

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59. *plumbo*, Mss. ? *plumbum*, Ed. — *tuto*, RdDal. Brot. May. *toto*, V. *tota*, h. omit, BSill.

60. *pruna*, K. *prunæ*, Mss. Sill. May.

61. *retinente*, BSill. May. *retinentes*, Al. — *striges*, BSill. May. *strigiles*, dhDal. Brot. *strigile*, VR.

62. *suam*, BSill. May. Omit. Al.

colour, for silver is brighter and more like sun-light (that is why it is more commonly used for military standards, since its gleaming is visible at a greater distance), and those who think it is the star-like hue of gold that charms are clearly mistaken, since no special importance is attached to such a colour in gems and other things; **(59.)** nor again is it preferred to the other metals by reason of its heaviness or its malleability, for in both it is surpassed by lead, but because it alone of all substances loses nothing on heating, and survives even conflagrations and the funeral pyre. In fact, the oftener it is heated the better it becomes, and ignition is the test for gold, that on heating till red hot it should still keep its colour. The test is called *obrussa*.

60. But the best proof of purity is a high melting-point. It is strange too that a substance unsubdued by charcoal, made from the most fiercely-burning wood, is swiftly heated by chaff, and that it is fused with lead to purify it.

Another and more important reason for holding gold in esteem is that it is least worn away by use. On the other hand, lines can be drawn with silver, copper, and lead, and the hands become soiled by the material that wears off. **61.** Again, nothing can be beaten into thinner leaves nor divided more finely, for an ounce of it is hammered out into seven hundred and fifty, or even more, gold-leaves measuring four fingers each way. The thickest of gold-leaves are called ‘ leaf of Praeneste ’, where the image of Fortune, gilded most faithfully, still helps to maintain the name. The next type of leaf is called ‘ quaestorian ’. In Spain, nuggets of gold are called *striges*.

62. Above all, it alone is found in nuggets or fine dust. The other metals, after discovery in the mines, have to be perfected by roasting, but gold is gold straight off. Its substance is perfect when found in this way, for the gold in this case is pure; in the other cases which we shall describe it has to be extracted. Finally, neither rust nor verdigris nor anything else can waste its excellence or diminish its weight.

63. Iam contra salis et aceti sucos, domitores rerum, constantia, superque omnia netur ac texitur lanæ modo vel sine lana. Tunica aurea triumphasse Tarquinium Priscum Verrius docet; nos videmus Agrippinam Claudii principis, edente eo navalis prœlii spectaculum, adsidentem et indutam paludamento aureo textili sine alia materia. Attalicis vere iampridem intexitur, invento regum Asiæ.

Sect. 20. **64.** Marmori et iis quæ candefieri non possunt ovi candido inlinitur, ligno glutini ratione composita; leucophorum vocant. Quid sit hoc aut quem ad modum fiat, suo loco docebimus. Æs inaurari argento vivo aut certe hydrargyro legitimum erat, de quis, ut dicemus illorum naturam reddentes, excogitata fraus est. **65.** Namque æs cruciatur in primis accensumque restinguitur sale, aceto, alumine; postea exa*min*atur an satis recoctum sit splendore deprehendente, iterumque exhalatur igni, ut possit, edomitum mixtis pumice *et* alumine, argento vivo inductas accipere bratteas. Alumen in purgando vim habet, qualem esse diximus plumbo.

Cap. IV. Sect. 21. **66.** Aurum invenitur in nostro orbe, ut omittamus Indicum a formicis aut apud Scythas gryphis erutum, tribus modis: fluminum ramentis, ut in Tago Hispaniæ, Pado Italiæ, Hebro Thraciæ, Pactolo Asiæ, Gange Indiæ, nec ullum absolutius aurum est, ut cursu ipso attrituque perpolitum.

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63. *constantiam superque superat omnia,* B. *constantia, superque omnia,* Al. Sill. *constantia superat omnia, superque,* May. — *vel,* BVRdPSill. May. *et,* hDal. Brot.

65. *primis,* Mss. *prunis,* Dr. D'Arcy Thompson (private communication). — *examinatur,* Conj. Ed. *exharenatur,* Mss. — *pumice et,* Conj. Ed. *pumice,* Mss. Most texts punctuate :— '*ut possit edomitum, mixtis pumice, alumine, argento vivo, inductas...*'

66. *tribus,* Conj. Bergk, May. *apud nos tribus,* Al. Sill. — *quæritur,* BSill. May. *quare,* VRdhPDal. Brot.

63. Again, brine and vinegar, the conquerors of matter, make no impression on it, and, more than any other metal, it is spun and woven like wool — even without wool.

According to Verrius, Tarquinius Priscus triumphed in a golden tunic, and we ourselves have seen Agrippina, wife of the Emperor Claudius, sitting beside him when he was exhibiting a mimic sea-fight, clad in a cloak woven of gold without other material. Indeed the method of weaving gold into Attalic cloth is old, and was invented by the kings of Asia.

Sect. 20. **64.** On marble and other objects which cannot be heated white-hot, gold is laid on with white of egg; on wood with a glue called *leucophorum*, made in accordance with a certain formula. Its composition and preparation will be described in its proper place.

It was legal to gild copper by means of quicksilver or at least hydrargyrum, in place of which a fraudulent substitute has been devised, as we shall relate when we are describing their properties.

65. The copper is first subjected to the violence of fire; then when red-hot, quenched with brine, vinegar, or alum. The brightness of the surface is then used as a test whether the heating has been sufficiently prolonged, and the copper is dried again by heat, so that, after polishing with a mixture of pumice and alum, it is fit to receive the gold-leaf laid on with mercury. Alum has purifying properties [in the case of copper] comparable to those already attributed to lead [in the case of gold].

Chap. IV. Sect. 21. **66.** In the world, as known to us, gold is found in three ways, not to mention gold dug up in India by ants, or by gryphons among the Scythians: firstly, in the sands carried down by rivers such as the Spanish Tagus, the Italian Padus, the Thracian Hebrus, the Asian Pactolus, and the Indian Ganges.

67. Alio modo puteorum scrobibus effoditur aut in ruina montium quæritur; utraque ratio dicatur. Aurum qui quærunt ante omnia segutilum tollunt; ita vocatur indicium. Alveus hic est harenæ, quæ lavatur, atque ex eo quod resedit coniectura capitur. Invenitur aliquando in summa tellure protinus rara felicitate, ut nuper in Delmatia principatu Neronis, singulis diebus etiam quinquagenas libras fundens. **68.** Cum ita inventum est in summo cæspite, talutium vocant, si et aurosa tellus subest. Cetero montes Hispaniarum aridi sterilesque et in quibus nihil aliud gignatur hoc bono fertiles esse coguntur. Quod puteis foditur, canalicium vocant, alii canaliense, marmoris glareae inhærens, non illo modo, quo in oriente sapphiro atque Thebaico aliisque in gemmis scintillat, sed micas amplexum marmoris.

69. Vagantur hi venarum canales per latera puteorum et huc illuc, inde nomine invento, tellusque ligneis columnis suspenditur. Quod effossum est, tunditur, lavatur, uritur, mollitur; farinam a pila scudem vocant; argentum quod exit a fornace sudorem; quæ e camino iactatur spurcitia in omni metallo scoria appellatur. Hæc in auro tunditur iterumque coquitur. Catini fiunt ex tasconio, hoc est terra alba similis argillæ; neque enim alia flatum ignemque et ardentem materiam tolerat.

70. Tertia ratio opera vicerit Gigantum; cuniculis per magna

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67. *harenæ quæ*, VDetl. May. *harenæ qua*, B. *harenæque*, RdThSill. — *lavatur*, BDetl. May. *lavantur*, Al. Sill.

68. *Cum ita*, BSill. May. *Cum mina*, V. *Cumina*, RTP. *Cum iam*, hDal. *Gummi*, dBrot. — *hoc*, Ed. (Conj. L. C. P.) *huic*, Mss. Sill. May.

69. *a pila scudem*, conj. Madvig, May. *apitascudem*, BSill. *apilascudem*, P. *apilascudunt*, V. *apilascudent*, R. *ac pilis cudunt*, d. *ac pilis cuditur*, Salmas. Brot. Omit. T. — *similis*, BVRdhDal. Brot. May. *simili*, TSill.

70. *atque purpuras*, BSill. May. Omit. Al.

This is the purest of all gold, polished finely by the friction of running water.

67. Secondly, it is mined by sinking shafts, or sought by the utter destructions of mountains. Let us explain both methods. Those who seek gold first of all remove the *segutilum*, that is the earth which indicates gold. Beneath is found a deposit of sand, which is washed, and an estimate is formed from the matter which sinks to the bottom. Sometimes gold is found straight off (a piece of rare good luck) on the surface of the earth, as happened lately in Delmatia, while Nero was Emperor, when the seam furnished as much as fifty pounds a day. **68.** When found thus on the surface, it is called *talutium*, if there is also gold-bearing earth underneath. The Spanish hills, otherwise dry and barren, and productive of nothing else, are constrained to bring forth this treasure. The name *canalicium* (or *canaliense*, according to others) is given to gold mined by means of shafts, found embedded in marble gravels, in a different form from that in which it sparkles in the eastern sapphire, the Theban stone, and other gems, for it embraces the particles of marble.

69. These channel-like veins, which are the source of the name *canalicium*, wander hither and thither round the sides of the shafts, and the earth is sustained by wooden props. The material which has been dug out is crushed, washed, roasted, and powdered. The fine flour that results from the pounding is called *scudes*, while the *argentum* sublimed from the hearth is known as the ‘ sweat ’. The refuse which is cast out of the furnace is always called *scoria*, whatever the metal concerned. In the case of gold this slag is crushed and again roasted. The hearths are made from *tasconium*, a white earth like potter’s clay, the only substance that can endure the blast, the heat of the fire, and the glowing charge.

70. The third way will be found to have surpassed the achieve-

spatia actis cavantur montes lucernarum ad lumina. Eadem mensura vigiliarum est multisque mensibus non cernitur dies. Arrugias id genus vocant siduntque rimæ subito et opprimunt operatos, ut iam minus temerarium videatur e profundo maris petere margaritas atque purpuras; tanto nocentiores fecimus terras. Relinquuntur itaque fornices crebri montibus sustinendis. **71.** Occursant in utroque genere silices; hos igne et aceto rumpunt, sæpius vero, quoniam id cuniculos vapore et fumo strangulat, cædunt fractariis CL libras ferri habentibus egeruntque umeris noctibus ac diebus per tenebras proximis tradentes; lucem novissimi cernunt. Si longior videtur silex, latus sequitur fossor ambitque, et tamen in silice facilior existimatur opera. **72.** Est namque terra ex quodam argillæ genere glarea mixta — gangadiam vocant — prope inexpugnabilis. Cuneis eam ferreis adgrediuntur et iisdem malleis, nihilque durius putant, nisi quod inter omnia auri fames durissima est. Peracto opere cervices fornicum ab ultimo cædunt; dat signum ruina eamque solus intellegit in cacumine eius montis vigil. **73.** Hic voce, nutu evocari iubet operas pariterque ipse devolat. Mons fractus cadit ab sese longe fragore qui concipi humana mente non possit, æque et flatu incredibili. Spectant victores ruinam naturæ. Nec tamen adhuc aurum est, nec sciere esse cum foderent, tantaque ad pericula et impendia satis causæ fuit sperare quod cuperent.

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71. *id cuniculos vapore et fumo*, BSill. May. *in cuniculis vapor et fumus*, VRdhDal. Brot. — *fractariis*, BTSill. May. *fracturis*, RhPDal. Brot. *stracturis*, V. *facturis*. l. — *ferri*, BVRdTSill. May. *ferri terram*, hPDal. *terram*, l. *terræ*, r. *fere*, Hard. Brot. — *habentibus*, BSill. May. *agentibus*, VRdhlPTDal. Brot. — *fossor*, BPint. Sill. May. *fossa*, VBrot. *fossam*, RdhPDal.

72. *cædunt*, Al. May. *cadunt*, BSill.

73. *nutu*, BSill. May. *nutuve*, Conj. Hard. *ictuve*, hTDal. Brot. *tinnituve*, Conj. Gron. — *æque et flatu*, VRdMay. *eque efflatu*, BSill. *eque et flatu*, T. *et flatu*, hDal. Brot. — *et impendia*, Conj. Gron. BSill. May. *evincenda*, hDal. *et incendia*, PVTdl. *et intendia*, R.

ments of the Giants, for mountains are excavated by lamplight by driving galleries far into their flanks. Lamps also serve to measure the spells of work, and for many months together the toilers are without the light of day. These mines they call *arrugiæ*. Miners are sometimes swallowed up by fissures that open suddenly beneath their feet, so that now it seems less foolhardy to seek pearls and purple-fish in the depths of the sea - so much more dangerous have we made the land. On account of this danger, arched supports are left at frequent intervals to bear the weight of the mountain.

71. In both kinds of mine, the miners meet with flinty rocks which they break up by heating them and pouring vinegar on them, or more often (for the steam and smoke make the air in the galleries unbreathable) they hew them out with shattering-machines fitted with iron rams weighing one hundred and fifty pounds, and they bear out the debris on their shoulders, night and day, passing it on in the darkness to their neighbours in the chain, of whom only the last see daylight. If the outcrop of flint seems too thick, the miner skirts the edge of it and circumvents it. Yet it sometimes seems less difficult to work through the flint, (**72.**) for the earth in places is of a certain kind of clay mixed with gravel — they call it *gangadia* — which can hardly be overcome. They attack it with iron wedges and the hammers mentioned above, and they consider that there is nothing more stubborn save the most stubborn thing of all, the hunger for gold.

When the operation is completed, they cut the supports close to the roof, beginning with the one which is farthest from the mouth. The subsidence of the earth gives a signal, seen only by a watcher stationed on a peak of the same mountain. **73.** By shouts and signals he bids them call out the miners, while

74. Alius par labor ac vel maioris impendii : flumina ad lavandam hanc ruinam iugis montium obiter duxere a centesimo plerumque lapide; corrugos vocant, a corrivatione credo; mille et hic labores. Præceps esse libramentum oportet, ut ruat verius quam fluat; itaque altissimis partibus ducitur. Convalles et intervalla substructis canalibus iunguntur, alibi rupes inviæ cæduntur sedemque trabibus cavatis præbere coguntur; is qui cædit funibus pendet, ut procul intuenti species ne ferarum quidem sed alitum fiat. **75.** Pendentes maiore ex parte librant et lineas itineri præducunt, quaque insistentis vestigiis hominis locus non est amnes trahuntur ab homine. Vitium lavandi et si fluens amnis lutum importet; id genus terræ urium vocant. Ergo per silices calculosve ducunt et urium evitant. Ad capita deiectus in superciliis montium piscinæ cavantur, ducenos pedes in quasque partes et in altitudinem denos. Emissaria in iis quina pedum quadratorum ternum fere relinquuntur, ut repleto stagno excussis opturamentis erumpat torrens tanta vi ut saxa provolvat. **76.** Alius

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74. *præceps esse*, BSill. May. *præcepisse*, VRPdhW. — *cavatis*, BhrSill. May. *cavatæ*, VRW.

75. *quaqua*, BSill. May. *itaque*, Al. *itur qua*, Conj. Pint. — *lavandi et*, BSill. *lavandi est*, Conj. Detl. Urlichs, May. *lavandi... lutum*, omitted by other mss.

76. *agogas*, BdhSill. May. *agangas*, TBrot. *agagas*, V. *agagans*, R. — *canales*, B^2 Jan. May. *canale*, VRPdSill. *canali*, hDal. Brot. *canalis*, B^1. Sillig punctuates before, not after, *canale*. — *labitur... in mare*, BSill. May. Omitted by other mss.

he too rushes down. Its own weight brings the shattered mountain down in widespread destruction, with a roar that can scarce be imagined by the mind of man, and causing a rush of air powerful beyond belief. Nature lies in ruins before the eyes of the conquerors. But even yet they have obtained no gold, nor had they any certainty when they began to dig. Mere hope of satisfying their desires was sufficient incentive to incur such peril and expense.

74. There remains another operation, equally toilsome and even more expensive. For they have often brought water, to wash the fallen material, from a distance of a hundred miles over the mountain-ridges. These pipe-lines they call *corrugi*, from *corrivatio* I imagine, and their construction involves a thousand toils. The fall must be sheer so that the water dashes down rather than flows, and accordingly it is led by the highest path possible. Valleys and gaps are bridged by built-up canals, and in other places the pick compels pathless crags to afford a bed for the hollow wooden troughs. The worker is suspended by ropes, so that to the distant observer he resembles, not indeed a wild creature only, but a winged one. **75.** Most of the levels are taken in this hanging position, and they mark the path by straight lines. Thus man leads rivers where there is not room for his foot to rest.

Again, the water is considered unsuitable for washing if the flowing stream brings down mud with it. The kind of clay that occasions this they call *urium*. So the stream is led through flinty or rocky ground and the *urium* avoided. At the brow of the cliff whence the water is to pour down they dig reservoirs, two hundred feet square and ten feet deep. In each case they leave five exits about three feet square, so that, when the reservoir is full and the flood-gates are opened, the jet of water leaps forth with such violence that it displaces the broken material.

76. One more difficulty remains to be surmounted on the level

etiamnum in plano labor. Fossæ per quas profluat cavantur — agogas vocant — eæ sternuntur gradatim ulice. Frutex est roris marini similis, asper aurumque retinens. Latera cluduntur tabulis ac per prærupta suspenduntur canales. Ita profluens terra in mare labitur ruptusque mons diluitur, ac longe terras in mare his de causis iam promovit Hispania. In priore genere quæ exhauriuntur immenso labore, ne occupent puteos, in hoc rigantur.

77. Aurum arrugia quæsitum non coquitur sed statim suum est. Inveniuntur ita massæ, nec non in puteis, et denas excedentes libras; palagas, alii palacurnas, iidem quod minutum est balucem vocant. Ulex siccatur, uritur, et cinis eius lavatur substrato cæspite herboso ut sidat aurum. **78.** Vicena milia pondo ad hunc modum annis singulis Asturiam atque Gallæciam et Lusitaniam præstare quidam prodiderunt, ita ut plurimum Asturia gignat; neque in alia terrarum parte tot sæculis perseverat hæc fertilitas. Italiæ parci vetere interdicto patrum diximus; alioqui nulla fecundior metallorum quoque erat tellus. Exstat lex censoria Victumularum aurifodinæ in Vercellensi agro, qua cavebatur ne plus quinque milia hominum in opere publicani haberent.

Sect. 22. **79.** Aurum faciendi est etiamnum una ratio ex auripigmento, quod in Syria foditur pictoribus in summa tellure, auri colore, sed fragile lapidum specularium modo; invitaveratque spes Gaium principem avidissimum auri, quamobrem iussit excoqui magnum pondus; et plane fecit aurum excellens, sed ita parvi ponderis ut detrimentum sentiret, propter avaritiam expertus, quamquam auripigmenti libræ X IIII permutarentur; nec postea temptatum ab ullo est.

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77. *alii,* BdTPSill. May. *ali,* VR. *Hispani, alii,* hDal. Brot. — *iidem,* RhW May. *idem,* BV. *id autem,* dSill.

ground. Trenches called *agogæ* are made to carry off the stream, and each sluice-box is strewn with *ulex*, a shrub akin to rosemary, rough, and suitable for receiving a deposit of gold. The sides are lined with planks and, where they pass over broken ground, the conduits are supported in mid-air. Thus the earth flows along and is carried smoothly to the sea, and the shattered mountain is washed away. The encroachment upon the sea of the Spanish coast, brought about in this way, is already considerable. The rubble which, in the method mentioned earlier, is drawn up with huge expenditure of labour to prevent choking of the shafts, is in this method washed out by the water.

77. Gold mined by the *arrugia* method does not require roasting, but occurs in the metallic condition. Nuggets are found (as also in shaft-mining), and they may even exceed ten pounds in weight. They are sometimes called *palagæ*, while others call the nuggets *palacurnæ* and the gold-dust *baluce*. The *ulex* is dried and ignited and its ash washed on a bed of grassy turf which catches the gold. **78.** According to certain writers, the annual yield by this method of Asturia, Gallaecia, and Lusitania amounts to twenty thousand pounds weight, of which the bulk comes from Asturia, and no other country has been ceaselessly productive for such a lengthy period. We have mentioned before that mining in Italy was forbidden by an early decree of the senate, but for which it would have been second to none in the production of metals. A censorial law is on record, about the gold-mine of Victumulae in the territory of Vercellae, by which the lessees were forbidden to employ more than five thousand men.

Sect. 22. **79.** There is, moreover, a recipe for making gold from orpiment, which occurs near the surface of the earth in Syria and is dug up for use by painters. Its hue is similar to that of gold, but it is brittle like the ‘ mirror stone ’. Hope of obtaining gold, which he coveted exceedingly, induced the Emperor Gaius to order a great quantity of it to be roasted, and he certainly obtained some excellent gold, but in such small quantity that, although the price of the orpiment was only four denarii a pound, he found that he had lost by the experiment, which was inspired by greed alone. The attempt has not been repeated.

Sect. 23. **80.** Omni auro inest argentum vario pondere, aliubi decima parte, aliubi octava; in uno tantum Gallæciæ metallo, quod vocant Albucrarense, tricesima sexta portio invenitur; ideo ceteris præstat. Ubicumque quinta argenti portio est, et electrum vocatur; scobes hæ reperiuntur in canaliensi. Fit et cura electrum argento addito. Quod si quintam portionem excessit, incudibus non resistit. **81.** Vetusta et electro auctoritas Homero teste, qui Menelai regiam auro, electro, argento, ebore fulgere tradit. Minervæ templum habet Lindos insulæ Rhodiorum, in quo Helena sacravit calicem ex electro; adicit historia, mammæ suæ mensura. Electri natura est ad lucernarum lumina clarius argento splendere. Quod est nativum et venena deprehendit; namque discurrunt in calicibus arcus cælestibus similes cum igneo stridore et gemina ratione prædicunt.

Sect. 24. **82.** Aurea statua prima omnium nulla inanitate, et antequam ex ære aliqua modo fieret quam vocant holosphyraton, in templo Anaitidis posita dicitur, quo situ terrarum nomen hoc signavimus, numine gentibus illis sacratissimo. Direpta ea est Antoni Parthicis rebus, scitumque narratur veteranorum unius Bononiæ hospitali divi Augusti cena, cum interrogatus esset verumne esset eum qui primus violasset id numen oculis membrisque captum expirasse. **83.** Respondit enim cum maxime Augustum e crure eius cenare, seque illum esse totumque sibi censum ex ea rapina. Hominum primus et auream statuam et solidam LXX circiter olympiade Gorgias Leontinus Delphis in templo posuit sibi; tantus erat docendæ artis oratoriæ quæstus.

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80. *Gallæciæ*, Conj. Sill. *calleciæ*, B. *Callæciæ*, Conj. Jan. May. *Galliæ*, VRdhPW. — *et electrum*, BSill. *electrum*, VRdhWMay. — *scobes*, BSill. May. *scrobes*, VRdhW.

82. *inanitate*, VRdhWMay. *vanitate*, BSill. See note. — *modo*, BSill. May. *illo modo*, VRdhW. — *verumne esset*, Conj. Jan. *sciretne*, B^2 Sill. May. Omitted by B^1. *essetne verum*, dhW. *essene verum*, VR.

83. *cum maxime*, B^1 VRdMay. *tum maxime*, B^2 hSill. — *LXX*, Mss. Sill. May. *LXXXX*, Conj. Bergk. See note.

Sect. 23. **80.** All gold contains silver but the proportion varies. In some cases one-tenth is present, in others one-eighth; in one mine only (the Gallaecian mine called Albucrarense) the proportion is one in thirty-six, the best known. A metal containing a fifth part of silver is also called electrum. This occurs as small particles in the case of *canaliense* gold. Electrum is also made artificially by adding silver to gold, but, if the proportion exceeds one in five, the alloy crumbles on the anvil.

81. Homer is our authority for believing that electrum has long been held in honour, for he tells that the palace of Menelaus shone with gold and electrum, silver and ivory. Lindos in the island of Rhodes boasts a temple of Minerva, in which Helen consecrated a chalice of electrum, and the detail is added that it was the same size as her breast. Electrum has the property of gleaming more brightly than silver in lamp-light, and the naturally occurring alloy acts also as a detector of poisons. For rainbow tints flicker in cups [of that material] and a crackling noise like that of a fire is heard, and thus twofold evidence is available.

82. The first solid gold *(holosphyraton)* statue is said to have been set up, even before any bronze statue was made in this style, in the temple of Anaitis, the position of which we have already indicated. This statue of the goddess, who is held in the greatest reverence by the natives, was carried off piecemeal during Antony's campaign in Parthia, and a good story is told of one of the veterans of Bononia who was entertaining the Emperor Augustus to dinner. Someone asked him whether it was true that the first man to lay sacrilegious hands on that deity had died after losing the use of his eyes and limbs. **83.** He answered that Augustus, at that very moment, was dining off the leg of the goddess, that he was the man in question and that the whole of his income was derived from that act of plunder. The first person to set up a solid gold statue to a human being

Sect. 25. **84.** Aurum pluribus modis pollet in remediis, vulneratisque et infantibus applicatur ut minus noceant quæ inferantur veneficia. Est et ipsi superlato vis malefica, gallinarum quoque et pecuariorum feturis; remedium abluere illatum et spargere eos quibus mederi velis. Torretur et cum salis gemino pondere, triplici misyos, ac rursus cum duabus salis portionibus et una lapidis quem schiston vocant. Ita virus traditur rebus una crematis in fictili vase; ipsum purum et incorruptum. Reliquus cinis servatus in fictili olla, ex qua illitas lichenas in facie lomento eo convenit ablui. **85.** Fistulas etiam sanat et quæ vocantur hæmorroides. Quodsi tritus pumex adiciatur, putria ulcera et tætri odoris emendat, ex melle vero decoctum cum melanthio illitum umbilico leniter solvit alvum. Auro verrucas curari M. Varro auctor est.

Cap. V. Sect. 26. **86.** Chrysocolla umor est in puteis quos diximus per venam auri defluens, crassescente limo rigoribus hibernis usque in duritiam pumicis. Laudatiorem eandem in ærariis metallis et proximam in argentariis fieri compertum est; invenitur et in plumbariis, vilior etiam auraria. In omnibus autem his metallis fit et cura, multum infra naturalem illam, immissis in venam aquis leniter hieme tota usque in Iunium mensem, dein siccatis Iunio et Iulio, ut plane intellegatur nihil aliud

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84. *misyos*, Ed. (as in 34, 117.) *missuis*, B^1. *missiis*, B^2. *missis*, VRT. *misso*, dhDal. *missyis*, Conj. Jan. May. — *traditur*, VR. *tradit*, dhW. *trahit*, BSill. May. — *olla*, BSill. May. Omit. Al. Jan. — *ex*, BVRdPrSill. May. *et ex*, hW. — *qua*, B. *aqua*, VRdhPrSill. May. — *illitas*, B^2. *illitus*, Al. Sill. May. For punctuation of passage, see note.

was Gorgias of Leontini, who erected one to himself in the temple at Delphi about the seventieth Olympiad (1); so much money was to be made by teaching oratory.

Sect. 25. **84.** Gold has many medical applications. It is laid upon wounded men and little children to protect them against magic potions. But it has itself a baleful influence when held over them, as it has on the offspring of fowl and cattle. To remedy this, the piece which has been applied should be washed and those whom you wish to cure sprinkled with the washings. Again, it is roasted with twice its weight of salt and three times its weight of misy, and later with two parts of salt and one of the stone known as schist. In this way the bane is transferred to the substances heated with it in an earthenware vessel, while the gold remains pure and untainted. An earthen jar is used to preserve the ash that remains, and ringworm on the face may be removed by smearing it with this ointment from the jar. **85.** It heals fistulas also, and what are called hemorrhoids. Mixed with powdered pumice, it is good for suppurating and foul-smelling ulcers. If boiled down in honey with *melanthium* and smeared on tho navel, it acts as a gentle laxative. According to M. Varro, warts are cured by gold.

Chap. V. Sect. 26. **86.** Chrysocolla is an exudation found in the shafts which we have already mentioned. It oozes down the vein of gold, and its muddy substance is congealed under the influence of the winter cold till it is as hard as pumice. It is well established that the best quality forms in copper mines and the next best in silver mines. It occurs in lead mines also, but this kind is inferior to that found in gold mines. In all these mines, however, it is also prepared artificially (though its worth is far below that of the natural product) by leading a gentle stream of water into the vein all through the winter till the month of June, and evaporating the extract in June and July. It is therefore perfectly clear that chrysocolla is none other than a decomposition

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(1) See note.

chrysocolla quam vena putris. **87.** Nativa duritia maxime distat, uvam vocant, et tamen illa quoque herba quam lutum appellant tinguitur. Natura est quæ lino lanæve ad sucum bibendum. Tunditur in pila, dein tenui cribro cernitur, postea molitur ac deinde tenuius cribratur; quidquid non transmeat, repetitur in pila, dein molitur. **88.** Pulvis semper in catinos digeritur et ex aceto maceratur ut omnis duritia solvatur, ac rursus tunditur, dein lavatur, in conchis siccatur. Tunc tinguitur alumine schisto et herba supra dicta, pingiturque antequam pingat. Refert quam bibula docilisque sit; nam nisi rapuit colorem, adduntur et scytanum atque turbistum; ita vocant medicamenta sorbere cogentia.

Sect. 27. **89.** Cum tinxere pictores, orobitin vocant eiusque duo genera faciunt, elutam quæ servatur in lomentum, et liquidam, globulis sudore resolutis. Hæc utraque genera in Cypro fiunt, laudatissima autem est in Armenia, secunda in Macedonia, largissima in Hispania. Summa commendationis, ut colorem in herba segetis læte virentis quam simillime reddat. **90.** Visumque iam est Neronis principis spectaculis harenam circi chrysocolla sterni, cum ipse concolori panno aurigaturus esset. Indocta opificum turba tribus eam generibus distinguit, asperam quæ taxatur in libras X VII, mediam quæ X V, attritam quam et herbaceam vocant, quæ X III. Sublinunt autem, harenosam priusquam inducant, atramento et parætonio. Hæc sunt tenacia eius, colore blanda. **91.** Parætonium, quoniam est natura pinguissimum et propter lævorem tenacissimum, atramento aspergitur, ne parætonii candor pallorem chrysocollæ adfert. Luteam putant

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87. *uvam*, BVRSill. May. *unam*, h. *ulvam*, d.. *luteam*, W. — *lino*, hSill. May. *ligno*, B.VRd.

88. *catinos*, VdhWMay. *catino*, BSill. — *in conchis*, VRdhWMay. B and Sillig omit *in* and put comma after *conchis*.

89. *elutam*, BdhSill. May. *eluta*, T. *ælucta*, V. *luteam*, W. Omit. R.

90. *quæ X III*, dhW. *X III*, BVRSill. May. — *harenosam*, Mss. Sill. *harenatum* or *herbaceam*, Conj. May., though not read in his text.

product of a vein of metal. **87.** Natural chrysocolla, which is called *uva*, differs from the artificial mainly in hardness, and yet it also is dyed with the herb called *lutum*. It resembles flax and wool in its property of absorbing vegetable dyes. It is ground in a mortar, sifted through a fine sieve, ground again and sifted more finely. Whatever does not pass through is put back into the mortar and ground once more. **88.** The powder from each sifting is distributed into vessels and digested with vinegar to break up all the hard particles. It is then ground once more, washed, and dried in shell-shaped vessels. Finally, it is dyed with fissile alum and the herb mentioned above, being itself painted before it is used as a paint. It is essential that it should possess the property of obedient absorption. If it fails to take up the dye, those mordants which are known as *scytanum* and *turbistum* are added.

Sect. 27. **89.** The dyed product is called *orobitis* by painters, who distinguish two species, the *eluta* (' washed '), which is kept for making lomentum, and the *liquida*, in which the small lumps are blended to a paste with liquid. Both these kinds are found in Cyprus, but the best quality comes from Armenia and the next best from Macedonia. Spain provides the greatest yield. The most esteemed variety closely resembles in colour the joyous verdure of the blade of corn. **90.** 'Ere now we have seen the arena of the circus strewn with chrysocolla at the spectacles given by the Emperor Nero, when he himself was to appear as a charioteer, dressed in a robe of the same colour. Ignorant workmen in general distinguish three varieties, the ' rough ', valued at seven denarii to the lb., the ' medium ', valued at five, and the ' powdered ', also called ' grass-green ', valued at three. But before they put on the sandy kind, they lay a foundation with atramentum and paraetonium. **91.** These hold the chrysocolla and soften its hue. The paraetonium, being naturally very unctuous, and adhesive by reason of its smoothness, is covered thinly

a luto herba dictam, quam ipsam cæruleo subtritam pro chrysocolla inducunt, vilissimo genere atque fallacissimo.

Sect. 28. **92.** Usus chrysocollæ et in medicina est ad purganda vulnera cum cera atque oleo; eadem per se arida siccat et contrahit. Datur et in angina orthopnœave, lingenda cum melle. Concitat vomitiones, miscetur et collyriis ad cicatrices oculorum ac viridibus emplastris ad dolores mitigandos, cicatrices trahendas. Hanc chrysocollam medici acesin appellant, quæ non est orobitis.

Sect. 29. **93.** Chrysocollam et aurifices sibi vindicant agglutinando auro, et inde omnes appellatas similiter virentes dicunt. Temperatur autem Cypria ærugine et pueri impubis urina addito nitro teriturque Cyprio ære in Cypriis mortariis; santernam vocant nostri. Ita feruminatur aurum quod argentosum vocant; signum est, si addita santerna nitescit. E diverso ærosum contrahit se hebetaturque et difficulter feruminatur; ad id glutinum fit auro et septima argenti parte ad supra dicta additis unaque tritis.

Sect. 30. **94.** Contexique par est reliqua circa hoc, ut universa naturæ contingat admiratio. Auro glutinum est tale, argilla ferro, cadmea æris massis, alumen lamnis, resina plumbo et marmori sed plumbum nigrum albo iungitur ipsumque album sibi oleo, item stagnum æramentis, stagno argentum. Pineis optime lignis æs ferrumque funditur, sed et Ægyptio papyro, paleis aurum.

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92. *lingenda*, Pint. BSill. May. *pingenda*, VRTd. *miscenda*, hDal. — *trahendas*, Mss. *tergendas*, Conj. Desaint Edn.

93. *appellatas*, BSill. May. *appellata*, VRPd. *appellatam*, ThW. — *virentes*, BVRdPSill. May. *utentes*, hW. — *nostri*, VRdhWMay. Omit. BSill.

94. *sed*, VRdhW. *et*, BSill. *at*, Conj. May. (before *plumbum*). — *Ægyptio*, BVSill. May. *Ægyptia*, dhW. *egypto*, R. *egyptiæ*, P. — *stagnum*, BVRhMay. *stannum*, Sill. — *stagno*, BVMay. *stanno*, Sill.

with atramentum, lest the glossy whiteness of the paraetonium should make the chrysocolla too pale. The name *lutea* is said to be derived from the herb *lutum*, which is itself ground up with caeruleum and put on as a substitute for chrysocolla, — a most inferior adulteration.

Sect. 28. **92.** In medicine too chrysocolla is made up with wax and oil for cleaning wounds. When used alone as a powder, it dries them up and draws them together. It is given as an electuary with honey in cases of quinsy and asthma. It is also an emetic, and is blended in salves for treatment of scars on the eyes, and in green ointments to relieve pain and contract the scars. This chrysocolla, which is different from *orobitis*, is called *acesis* by physicians.

Sect. 29. **93.** Goldsmiths also claim chrysocolla as their own for soldering gold, saying that all other varieties with a similar verdant hue were named from this one. It is mixed in due proportion with Cyprian verdigris and the urine of a beardless boy. Nitrum (Carbonate of Soda) is added, and the whole triturated with a pestle of Cyprian copper in a mortar of the same material. The mixture obtained we call santerna. With it is soldered gold which contains silver, the presence of which is indicated by the brilliance of the surface when the santerna is applied. On the other hand, gold which contains copper contracts and grows dull, and is soldered with difficulty. For this kind of metal, the solder is made by adding gold and one-seventh part of silver to the substances mentioned above, and grinding them all together.

Sect. 30. **94.** Other similar facts may well be grouped with this, that Nature may have her meed of admiration from all. Gold is soldered with the mixture described above, iron with clay, masses of copper with cadmea, copper plates with alum, lead and marble with resin, but black lead [lead] is soldered with white lead [tin], and white lead to itself by means of oil. Stagnum too

Calx aqua accenditur et Thracius lapis ; idem oleo restinguitur, ignis autem aceto maxime et visco et ovo. Terra minime flagrat. Carboni vis maior exusto iterumque flagranti.

Cap. VI. Sect. 31. **95.** Ab his argenti metalla dicantur, quæ sequens insania est. Nonnisi in puteis reperitur nullaque spe sui nascitur, nullis ut in auro lucentibus scintillis; terra est alias rubra, alias cineracea. Excoqui non potest nisi cum plumbo nigro aut cum vena plumbi — galenam vocant — quæ iuxta argenti venas plerumque reperitur. Et eodem opere ignium discedit pars in plumbum, argentum autem innatat superne ut oleum aquis. **96.** Reperitur in omnibus pæne provinciis sed in Hispania pulcherrimum, id quoque in sterili solo atque etiam montibus, et ubicumque una inventa vena est, non procul invenitur alia; hoc quidem et in omni fere materia, unde metalla Græci videntur dixisse. Mirum adhuc per Hispanias ab Hannibale inchoatos durare puteos. **97.** Sua nomina ab inventoribus habent, ex quis Bæbelo appellatur hodieque, qui CCC pondo Hannibali subministravit in dies, ad MD passus iam cavato monte, per quod spatium Aquitani stantes noctibus diebusque egerunt aquas lucernarum mensura amnemque faciunt. Argenti vena in summo reperta crudaria appellatur. **98.** Finis antiquis fodiendi solebat esse alumen inventum; ultra nihil quærebatur. Nuper inventa æris vena infra alumen nullam finem spei fecit. Odor ex argenti fodinis inimicus omnibus animalibus sed maxime canibus. Aurum argentumque

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95. *alias*, BSill. May. *alia*, dhW. *abilia*, VR. — *discedit*, BSill. May. *descendit*, VRdhPW.

97. *Aquitani*, Mss. Sill. May. *Iacetani*, conj. Pint. *Accitani*, conj. Hard. *aquatini*, conj. Sill. (not read in his text).

98. *nullam*, BSill. May. *alba nullum*, hDal. *alba*, dTBrot. *vena alba*, P. *vena albam*, VR.

is soldered with copper, and silver with stagnum. Pine-logs make the best fire for melting copper and iron, but Egyptian papyrus is also serviceable, and gold is melted on a fire of chaff. Lime develops heat in contact with water, and so does Thracian stone. The latter is quenched by oil, but fire is best quenched by vinegar and birdlime and egg. Earth is the least combustible of all substances. Charcoal, on a second ignition, burns more furiously.

Chap. VI. Sect. 31. **95.** Our next subject is the mining of silver, a second manifestation of madness. It is found only in shaft-mines, and there is no previous indication of its presence, for there are no glinting sparks as in the case of gold; the earth is red in places and ash-coloured in others. The method of refining universally employed is heating with lead or the lead ore called galena, which is usually found close to veins of silver. In this smelting operation part of the ore separates into the lead, but the silver floats on top like oil on water. **96.** Silver is found in almost all the provinces, but the best comes from Spain. Like gold, it occurs in barren soil and even among mountains, and, wherever one vein is found, another is not far to seek. This is the case also with most other ores, and seems to be the source of the Greek name *metalla*. It is wonderful that the mines opened by Hannibal in Spain are still productive. **97.** They are named after the original discoverers, and one, which furnished Hannibal with three hundred lbs. daily, is called Baebelo unto this day. The excavations now extend fifteen hundred paces into the mountain, and, throughout the whole distance, the Aquitanians stand and bale out water in lamp-measured watches night and day till a river is made. The vein of silver that is found nearest the surface is called *crudaria*. **98.** The early miners used to cease operations when they came to *alumen*, seeking no further, but the recent discovery of veins of copper below the *alumen* has removed this limit to their hopes. The exhalation from the silver mines is poisonous

quo mollius, eo pulchrius. Lineas ex argento nigras præduci plerique mirantur.

Sect. 32. **99.** Est et lapis in iis venis, cuius vomica liquoris æterni argentum vivum appellatur. Venenum rerum omnium est perrumpitque vasa permanans tabe dira. Omnia ei innatant præter aurum; id unum ad se trahit. Ideo et optime purgat, ceteras eius sordes exspuens crebro iactatu fictilibus in vasis; ita vitiis abiectis, ut et ipsum ab auro discedat, in pelles subactas effunditur, per quas sudoris vice defluens purum relinquit aurum. **100.** Ergo et cum æra inaurentur, sublitum bratteis pertinacissime retinet; verum pallore detegit simplices aut prætenues bratteas. Quapropter id furtum quærentes ovi liquore candido usum eum adulteravere, mox et hydrargyr*um*, de quo dicemus suo loco. Et alias argentum vivum non largum inventum est.

Sect. 33. **101.** In iisdem argenti metallis invenitur, ut proprie dicamus, spumæ lapis candidæ nitentisque, non tamen translucentis; stimmi appellant, alii stibi, alii alabastrum, aliqui larbasim. Duo eius genera, mas et femina. Magis probant feminam; horridior est mas scabriorque et minus ponderosus minusque radians et harenosior; femina contra nitet, friabilis, fissurisque non globis dehiscens.

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99. *iis*, BMay. *his*, VRhSill. *huius*, d. — *ita vitiis*, hDal. May. *ita ut iis*, B. *ita vitis*, VR. *avitis*, dT. *ita*, lP. *ita autem iis*, conj. Sill. *alutis*, conj. Pint. Brot. *vestibus*, conj. Hard. — *abiectis*, hDal. *eiectis*, Conj. Jan. Sill. May. *tectis*, B. *iniectis*, RdlPBrot. *invectis*, V. *in ietis*, T. — *ut et*, hSill. May. *et ut*, B. *sed ut*, VRdTBrot. *ut*, Dal.

100. *hydrargyrum*, conj. Desaint edn. *hydrargyro*, Mss. Sill. May. — *inventum*, Mss. Sill. *inventu*, conj. Url. Detl. May.

101. *dicamus*, hSill. *dicatus*, B^1. *dictus*, B^2. *dicatur*, conj. May. *dicemus*, VRd. — *stimmi*, DhSill. May. *stimi*, PR. *timi*, V. *simi*, B. — *stibi*, BVSill. May. *stibia*, RP. *stybiam*, dh. *stibium*, W. — *larbasim*, BSill. May. *labasim*, P. *turbasim*, r. *turbasin*, VRTdh. *larbason*, conj. Barbarus after *λάρβασον* in Dioscorides.

to all animals, but especially to dogs. The softer gold and silver are, the more beautiful they are thought to be. It is a source of wonder to many that black lines can be drawn with silver.

Sect. 32. **99.** In those mines is found also a rock which exudes a permanent liquid called quicksilver. It is poisonous to everything, and is such a corrosive liquid that it eats its way through the vessels in which it is placed. All things float in it except gold; gold alone it draws to itself. For this reason it is also an excellent purifying agent, the contaminating matter being separated by prolonged agitation in vessels of earthenware. When the impurities have been thus rejected, the quicksilver is removed from the gold by pouring into tawed skins, through which the quicksilver oozes like sweat and leaves pure gold. **100.** So also when copper is being gilded, if the gold-leaf is underlaid with quicksilver, it is held very firmly by the latter. By its pallor, however, the quicksilver betrays single leaves or those that are very thin. Wherefore those who wish to gain by such dishonesty have illegitimately introduced into this process the use of white of egg; and more recently they have falsified also hydrargyrum, which will be described later. In other places, quicksilver is not found in abundance.

Sect. 33. **101.** In the same silver-mines is found what we might best describe as petrified foam, white and shining, but not transparent. It is variously called *stimmi*, *stibi*, *alabastrum*, and *larbasis*. There are two varieties, male and female, of which the female is considered the better. The male is coarser, rougher, and less dense. Its surface is not shining and it contains more grit. The female, on the other hand, glistens and is easily broken, showing a lengthways cleavage instead of crumbling into small lumps.

Sect. 34. **102.** Vis eius adstringere ac refrigerare, principalis autem circa oculos; namque ideo etiam plerique platyophthalmon id appellavere, quoniam in calliblepharis mulierum dilatet oculos. Et fluctiones inhibet oculorum exulcerationesque farina eius et turis, cummi admixto. Sistit et sanguinem e cerebro profluentem, efficacissime et contra recentia vulnera et contra veteres canum morsus inspersa farina, et contra ambusta igni cum adipe ac spuma argenti cerussaque et cera.

103. Uritur autem offis bubuli fimi circumlitum in clibanis; dein restinguitur mulierum lacte teriturque in mortariis, immixta aqua pluvia; ac subinde turbidum transfunditur in æreum vas et mundatur nitro. Fæx eius intellegitur plumbosissima quæ subsedit in mortario abiciturque. Dein vas, in quod turbida transfusa sunt, opertum linteo per noctem relinquitur et postero die quidquid innatat effunditur spongeave tollitur. **104.** Quod ubi subsedit flos intellegitur ac linteo interposito in sole siccatur, non ut perarescat, iterumque in mortario teritur et in pastillos dividitur. Ante omnia autem urendi modus necessarius est, ne plumbum fiat. Quidam non fimo utuntur coquentes sed adipe. Alii tritum in aqua triplici linteo saccant fæcemque abiciunt idque quod effluxit transfundunt, quidquid subsidat colligentes. Emplastris quoque et collyriis miscent.

Sect. 35. **105.** Scoriam in argento Græci vocant helcysma. Vis eius adstringere et refrigerare corpora. † Acre dies † additur emplastris ut molybdæna, de qua dicemus in plumbo, cicatricibus maxime glutinandis, et contra tenesmos dysenteriasque infusa

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102. *efficacissime*, B. May. *efficacissimum*, conj. Sill. *efficacior*, hPW. *efficax*, dT. *efficaci*, RV.

103. *et mundatur*, W. *emundatum*, BSill. May. *et mundatum*, r. *mundatur*, R. *emundatur*, dT. *et mandatur*, h. — *sunt*, VRdhPW. *sit*, B. *sint*, conj. Sill. May.

104. *effluxit*, BSill. *defluxit*, VRdWMay. *defluerit*, r. *defluxerit*, h.

105. *acre dies*, B^1 (before *additur*). *hac re*, B^2. Om., Al. Sill. *hac de re*, Detl. *quare his*, Müller. *ac remedio est*, May. (suggesting also *acribus*, *viridibus*, or *a Græcis*). See notes. — *additur*, Mss. Sill. *addita*, Conj. May.

Sect. 34. **102.** It has astringent and cooling properties, but its principal use concerns the eyes, and this is why many call it *platyophthalmus* (eye-dilator), since it is the active principle in beauty-preparations for dilating the eyes of women. To prevent ulcerations and discharges from the eyes, it is powdered with frankincense and made up with gum. It checks bleeding from the nose, and a sprinkling of the powder is an excellent remedy for fresh wounds and old dog-bites. For burns it is applied with fat and ' silver-scum ', or white lead and wax.

103. It is roasted in an oven, after smearing with lumps of cow-dung, then quenched with mothers' milk and ground in a mortar after addition of rain-water. Next the turbid liquid is transferred to a copper vessel and purified with soda. The precipitate which sinks to the bottom in the mortar is considered to be very rich in lead, and is rejected. Then the vessel, into which the turbid liquid has been transferred, is covered with a cloth and left overnight. The supernatant fluid is poured off next day, or removed with a sponge. **104.** The solid that subsides is considered to be the best and is dried in the sun with a cloth over it, but not so as to remove all moisture. It is then ground again in a mortar and made up in little tablets. It is a matter of prime importance that the roasting should not be too vigorous, lest the product turn into lead. Some workers use fat instead of dung in the roasting; others strain through a triple cloth the product which has been ground up with water and reject the residue. The filtrate is transferred to another vessel, and the deposit collected and used for mixing with plasters and eyesalves.

Sect. 35. **105.** The Greeks give the name *helcysma* to the slag in the case of silver. It has astringent and cooling properties, and, like molybdaena, mentioned under lead, is an ingredient of plasters, especially those for closing up wounds. It is also mixed

clysteribus cum myrteo oleo. Addunt et in medicamenta quæ vocant liparas, ad excrescentia ulcerum aut ex attritu facta aut in capite manantia.

106. Fit in iisdem metallis et quæ vocatur spuma argenti. Genera eius tria : optima quam chrysitim vocant, sequens quam argyritim, tertia quam molybditim. Et plerumque omnes hi colores in iisdem tubulis inveniuntur. Probatissima est Attica, proxima Hispaniensis. Chrysitis ex vena ipsa fit, argyritis ex argento, molybditis e plumbi ipsius fusura, quæ fit Puteolis et inde habet nomen. **107.** Omnis autem fit, excocta sua materia, ex superiore catino defluens in inferiorem et ex eo sublata vericulis ferreis atque in ipsa flamma convoluta vericulo, ut sit modici ponderis. Est autem, ut ex eo nomine intellegi potest, fervescentis et futuræ materiæ spuma. Distat a scoria quo potest spuma a fæce distare; alterum purgantis se materiæ, alterum purgatæ vitium est. **108.** Quidam duo genera faciunt spumæ, quæ vocant scirerytida et peumenen, tertium molybdænam in plumbo dicendam. Spuma ut sit utilis, iterum coquitur confractis tubulis ad magnitudinem anulorum; ita accensa follibus ad separandos carbones cineremque abluitur aceto aut vino simulque restinguitur. Quodsi sit argyritis, ut candor ei detur, magnitudine fabæ confracta in fictili coqui iubetur ex aqua, addito in linteolis tritico et hordeo novis, donec ea purgentur. **109.** Postea sex diebus terunt in mortariis, ter die abluentes aqua frigida et cum desinant calida, addito sale fossili, in libram spumæ obolo; novissimo die dein condunt in plumbeo vase. Alii cum faba candida et ptisana coquunt siccantque sole, alii in lana candida cum faba, donec lanam non denigret. Tunc salem fossilem adiciunt, subinde aqua

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107. *et futuræ*, B^{1}VRdhSill. May. *et foturæ*, B^{2}. *et ficture*, P. *et fusæ*, K. Omit. lBrot. *et flucturæ*, conj. Jan. *e fusura*, conj. May. (not read in text).

108. *anulorum*, Mss. WMay. *abellanarum*, conj. Barbarus, Sill. *nucularum*, conj. Jan.

109. *desinant*, hSill. *desinat*, BVRd. *dies desinat*, conj. May. — *die dein condunt*, BJan. May. *die condunt*, dhSill. *die incondunt*, V. *die in combunt*, R.

with myrtle oil as an enema for cases of constipation and dysentery, and added to the ointments called ‘ liparae ’ for proud flesh, sores caused by rubbing, and running sores on the head.

106. From the same ores is made what is called ‘ scum of silver ’. There are three varieties — the best, called chrysitis, the second, called argyritis, and the third, called molybditis, all three colours being usually found in the same tubes. ‘ Silver-scum ’ from Attica is valued most highly, the next best coming from Spain. Chrysitis is made from the original ore, argyritis from silver, and molybditis from the smelting of lead itself. Molybditis is made at Puteoli — whence the name.

107. All varieties, however, are made in the same way. The raw material is melted and the ‘ silver-scum ’ flows down from the upper cauldron into one placed below, from which it is removed with iron spikes, each spike-load being revolved in the flame to make it less dense. It is indeed, as the name indicates, scum from the boiling mass which is to provide the metal. It differs from slag as scum differs from lees, the former being an impurity of matter in course of refining, the latter an impurity left by the refined substance.

108. Some authorities recognise only two kinds of ‘ scum ’, called scirerytis and peumen, considering the third to be molybdaena, to be mentioned under lead. To prepare the ‘ scum ’ for use, the tubes are broken into pieces the size of rings and melted again. When it has been heated strongly, with the help of bellows, to separate coals and ashes, it is washed with vinegar or wine and thus quenched. To improve the bright appearance of argyritis, one is recommended to break it into fragments the size of a bean and heat in an earthen vessel with water, in which one puts fresh wheat and barley in a bag, till the grains lose their husks. **109.** It is subsequently triturated in mortars for six days, being washed thrice a day with cold water, and, on ceasing operations, with hot water containing one obol of mine-salt to the pound

mutata, siccantque diebus XL calidissimis æstatis. Nec non in ventre suillo in aqua coquunt exemptamque nitro fricant et, ut supra, terunt in mortariis cum sale. Sunt qui non coquant sed cum sale terant et adiecta aqua abluant. **110.** Usus eius ad collyria et litu ad muliebrium cicatricum fœditates tollendas maculasque, abluendum capillum. Vis autem siccare, mollire, refrigerare, temperare, purgare, explere ulcera, tumores lenire, talibusque emplastris additur et liparis supra dictis. Ignes etiam sacros tollit cum ruta myrtisque et aceto, item perniones cum myrtis et cera.

Cap. VII. Sect. 36. **111.** In argentariis metallis invenitur minium quoque, et nunc inter pigmenta magnæ auctoritatis et quondam apud Romanos non solum maximæ sed etiam sacræ. Enumerat auctores Verrius, quibus credere necesse sit, Iovis ipsius simulacri faciem diebus fastis minio inlini solitam triumphantiumque corpora; sic Camillum triumphasse. **112.** Hac religione etiamnum addi in unguenta cenæ triumphalis, et a censoribus in primis Iovem miniandum locari. Cuius rei causam equidem miror, quamquam et hodie id expeti constat Æthiopum populis totosque eo tingui proceres, hunc ibi deorum simulacris colorem esse. Quapropter diligentius persequemur omnia de eo.

Sect. 37. **113.** Theophrastus LXXXX annis ante Praxibulum

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110. *litu ad*, R (Codd. Barbari) Sill. *litum*, BV. *litum ad*, d. *nitrum ad*, h. *cuti*, conj. May. — *abluendum*, BVRdhWSill. May. *ad alendum*, conj. Jan. — *additur et liparis*, B. Sill. May. Omit. Al. Perhaps *additur, liparis* is the true reading.

113. *CCCXLVIIII*, Conj. Barbarus, Brot. May. *CCXLVIIII*, BVRdDal. *CCCCXXXIX*, Conj. Casaubon, Sill. — *harena rubente*, hPW. *harenæ rubenti*, BVRdSill. May.

of ‘ scum ’. Then, on the last day, they store it in a leaden vessel. Another way is to boil with white beans and crushed barley and dry in the sun, or else with white wool and beans till it ceases to blacken the wool. Then they add mine-salt, changing the water frequently, and dry on the forty hottest days of summer. Alternatively, it may be boiled with water in a sow's paunch, taken out and rubbed with soda, and triturated with salt in mortars, as described above. Some, instead of boiling, rub it with salt and wash it clean with water.

110. ‘ Scum of silver ’ is used in eye-salves, and as a liniment by women for removing ugly scars and blemishes, and for cleansing the hair. It has drying properties, soothes, cools, moderates, and cleanses, fills up ulcers and reduces swellings, and so it is used in plasters for such purposes, and in the *liparae* mentioned above. It cures erisypelas too when mixed with rue, myrtle-berries, and vinegar, and chilblains when mixed with myrtle-berries and wax.

Chap. VII. Sect. 36. **111.** Another thing found in silver mines is minium, still one of the most valued pigments, and formerly held not merely in honour but in veneration by the Romans. Verrius gives a list of authorities who inspire confidence, to prove that it was customary on festive occasions to paint with minium the face of the image of Jove himself, and that the bodies of triumphing generals were similarly stained, a custom followed by Camillus in his triumph. **112.** Through this sense of its sacredness, it was also added to the unguents used at the triumphal banquet, and to make a contract for painting Jove was one of the first duties of the censors.

Why this is so I wonder, and yet it is known that minium is still in demand among the Aethiopian peoples, that their chieftains dye themselves with it from head to foot, and that this is the colour they use for the images of their gods. For this reason we shall the more diligently investigate all the facts.

Sect. 37. **113.** Theophrastus relates that the original discovery

Atheniensium magistratum — quod tempus exit in urbis nostræ CCCXLVIIII annum — tradit inventum minium a Callia Atheniense initio sperante aurum excoqui posse harena rubente in metallis argenti; hanc fuisse originem eius. **114.** Reperiri autem iam tum in Hispania, sed durum et harenosum, item apud Colchos in rupe quadam inaccessa, ex qua iaculantes decuterent; id esse adulterum, optimum vero supra Ephesum Cilbianis agris, harena cocci colorem habente; hanc teri, dein lavari farinam et quod subsidat iterum lavari. Differentiam artis esse, quod alii minium faciant prima lotura, apud alios id esse dilutius, sequentis autem loturæ optimum.

Sect. 38. **115.** Auctoritatem colori fuisse non miror. Iam inem Troianis temporibus rubrica in honore erat, Homero teste qui naves ea commendat, alias circa pigmenta picturasque rarus. Milton vocant Græci miniumque cinnabarim, unde natus error Indic*æ* cinnabaris nomine. **116.** Sic enim appellant illi saniem draconis elisi elephantorum morientium pondere, permixto utriusque animalis sanguine, ut diximus; neque est alius colos qui in pictura proprie sanguinem reddat. Illa cinnabaris antidotis medicamentisque utilissima est. At Hercules, medici, quia cinnabarim vocant, utuntur hoc minio quod venenum esse paulo mox docebimus.

Sect. 39. **117.** Cinnabari veteres quæ etiam nunc vocant monochromata pingebant. Pinxerunt et Ephesio minio, quod derelictum est quia curatio magni operis erat. Præterea utrumque nimis acre existimabatur; ideo transiere ad rubricam et sinopidem,

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114. *iăm tum,* Mss. Sill. May. *nativum,* Conj. Hard. (v. Notes).
115. *Indicæ cinnabaris nomine,* Conj. Ed. *indicio nominum,* BSill. *Indico nomine,* VRd. Jan. *Indico cinnabaris nomine,* hW. *inscitia nominum,* Conj. May.
116. *Hercules,* BSill. May. *Hercule,* Al.
117. *sorbis,* Al. Sill. *sorvis,* B¹ Jan. May.

of minium was made ninety years before the archonship of Praxibulus (that is, in the three hundred and forty ninth year of our city), by Callias, an Athenian, who hoped at first that gold could be extracted by roasting from the red sand which occurs in silver-mines. **114.** He adds that, before his time, a hard and sandy variety had been discovered in Spain, and that it has also been found among the Colchians on a certain inaccessible crag, from which they knock it down by throwing javelins at it. This variety, however, was impure, and the best comes from the Cilbian plains beyond Ephesus, where the sand has the colour of the kermes berry. This is ground to a powder, washed, and allowed to subside, the deposit being subjected to further washing. Differences of procedure are found. Some, in preparing the minium, wash only once. Others find that this gives too weak a colour and wash a second time to get a superior product.

Sect. 38. **115.** I am not surprised at the esteem in which the colour was held. For even in Trojan times red earth was honoured, as we learn from Homer who makes his ships agreeable with it, although he rarely speaks elsewhere of paints and painting. The Greeks call the red earth *miltos* and minium they call *cinnabar*, whence mistakes have arisen on account of the name ‘Indian cinnabar’. **116.** For this name is given by them to the gore of the dragon crushed beneath the weight of the dying elephants, a substance in which, as we have already related, the blood of both animals was mingled, and which is the only colour which properly represents blood in painting. This kind of cinnabar is very useful for antidotes and medicines, but, by Hercules, because it also is called cinnabar, doctors employ that minium which we shall shortly show to be a poison.

Sect. 39. **117.** Cinnabar was used by the early artists for what are still called *monochromata*. The use of Ephesian minium, which they also employed, was abandoned on account of the difficulty of preservation. Besides that, both colours were deemed too vivid; so they had recourse to rubrica and sinopis [red ochres]

de quibus suis locis dicam. Cinnabaris adulteratur sanguine caprino aut sorbis tritis. Pretium sinceræ nummi quinquaginta.

Sect. 40. **118.** Iuba minium nasci et in Carmania tradit, Timagenes et in Æthiopia. Sed neutro ex loco invehitur ad nos nec fere aliunde quam ex Hispania, celeberrimo Sisaponensi regione in Bætica miniario metallo vectigalibus populi Romani. Nullius rei diligentiore custodia, non licet ibi perficere id excoquique; Romam adfertur vena signata ad dena milia fere pondo annua, Romæ autem lavatur, in vendendo pretio statuta lege ne modum excederet HS.LXX in libras; sed adulteratur multis modis, unde præda societati. **119.** Namque est alterum genus omnibus fere argentariis itemque plumbariis metallis, quod fit exusto lapide venis permixto, non ex illo cuius vomicam argentum vivum appellavimus — is enim et ipse in argentum *vivum* excoquitur, — sed ex aliis simul repertis. Steriles etiam, plumbi deprehenduntur solo colore nec nisi in fornacibus rubescentes, exustique tunduntur in farinam. **120.** Hoc est secundarium minium perquam paucis notum, multum infra naturales illas harenas. Hoc ergo adulteratur minium in officinis sociorum, et u*b*ivis Syrico; quonam modo Syricum fiat, suo loco docebimus. Sublini autem Syrico minium compendii ratio demonstrat. Et alio modo pingentium furto opportunum est plenos subinde abluentium penicillos; sidit autem in aqua constatque furantibus.

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118. *celeberrimo*, Conj. Sill. May. *celerrimo*, B. *celeberrimu*, V. *celeberrimum*, dhW. — *excoquique*, RdhSill. *excoqui quæ*, B. *excoctique*, VMay. *excoctumque*, r. See Note. — *dena*, Al. *bina*, BSill. May.

119. *vivum excoquitur*, Conj. Ed. *excoquitur*, Mss. — *deprehenduntur*, Al. Sill. *de micæ prehenduntur*, B^1. *micæ. Deprehenduntur*, B^2 Detl. May.

120. *et ubivis*, Conj. Jan. *item*, VRdhPSill. *et vivis*, B. *et vilius*, conj. May.

which will be described in their proper places. Cinnabar is adulterated with goat's blood or pounded service-berries. The pure material costs fifty sesterces [a lb.].

Sect. 40. **118.** Juba relates that minium is also found in Carmania, and Timagenes that it occurs in Aethiopia, but we import none from either country. Almost our entire supply comes from Spain, from that famous minium mine in the region of Sisapo in Baetica, which is a source of revenue to the Roman people. Nothing is more jealously guarded, for it is illegal to refine and roast it there. The ore is brought to Rome under seal to the extent of about ten thousand lbs. per annum, and is there washed. A law has been passed fixing the maximum selling price at seventy sesterces a lb., but it is adulterated in many ways — so much illicit profit to the company! **119.** For there is a second kind which occurs in almost all silver and lead mines and is prepared by burning certain rocks which are mixed with the main vein of ore — not those rocks whose exudation we call quicksilver, for the product obtained by roasting them is also quicksilver — but others found simultaneously. These contain no quicksilver and are recognized only by their leaden colour, for they do not become red until they have been heated in the furnace, after which they are pounded to powder. **120.** This is a second-rate kind of minium, known to very few and far inferior to the native 'sands' already mentioned. It is used in the company's workshops to adulterate genuine minium. *Syricum*, the manufacture of which will be described in its proper place, may also be employed at will. A calculation, however, made by weighing one against another reveals a minium that has been treated with *Syricum*. In another way, it is convenient for dishonest painters who repeatedly charge their brushes and then dip them in water. The pigment settles and remains at the bottom for the thieves.

121. Sincero cocci nitor esse debet, secundarii autem splendor in parietibus sentit *rob*iginem, quamquam hoc robigo quædam metalli est. Sisaponensibus autem miniariis sua vena harenæ sine argento; excoquitur auri modo. Probatur auro candente; fucatum enim nigrescit, sincerum retinet colorem. Invenio et calce adulterari ac simili ratione, ferri candentis lamna si non sit aurum, deprehendi. **122.** Inlito solis atque lunæ contactus inimicus; remedium, ut pariete siccato cera Punica cum oleo liquefacta candens sætis inducatur iterumque admotis gallæ carbonibus inuratur ad sudorem usque, postea candelis subigatur ac deinde linteis puris, sicut et marmora nitescunt. Qui minium in officinis poliunt faciem laxis vesicis inligant, ne in respirando pernicialem pulverem trahant et tamen ut per illas spectent. Minium in voluminum quoque scriptura usurpatur clarioresque litteras vel in auro vel in marmore, etiam in sepulchris fecit.

Cap. VIII. Sect. 41. **123.** Ex secundario invenit vita et hydrargyrum in vicem argenti vivi, paulo ante dilatum. Fit autem duobus modis, æreis mortariis pistillisque trito minio ex aceto, aut patinis fictilibus impositum ferrea concha, calice coopertum, argilla superinlita, dein sub patinis accensum follibus continuis igni atque ita, calici sudore deterso qui fit argenti colore et aquæ liquore, idem guttis dividi facilis et lubrico umore compluere.

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121. *sentit*, dhWMay. *sentire*, BVRSill. — *robiginem*, Conj. Ed. *imaginem*, Mss. Jan. *uliginem*, Cæsarii Ed. (1524), Sill. *plumbaginem*, Conj. May. See Note. — *sua vena harenæ*, BSill. May. *sua vero arena*, VR. *sua arena*, d. *suæ venæ arena*, hW.

122. *Inlito solis*, Sill. May. *inlito. Solis*, BVR. *illico. Solis*, dhW. — *ut per*, Mss. Sill. *super*, Conj. May. — *auro*, Mss. Sill. *muro*, Conj. Detl. May. *ære*, Conj. Hübner. — *fecit*, BSill. May. *facit*, Al.

123. *accensum*, Mss. Sill. *accenso*, K., Jan. May. — *calici*, BdSill. May. *calicis*, VRhW. — *compluere*, BSill. May. *confluere*, Al.

121. Pure minium should have the brilliancy of kermes, but when the second-rate minium is used for mural paintings it experiences rusting, though it is itself the rust of a metal.

In the minium mines of Sisapo the vein of ‘ sand ’ is pure and contains no silver. It is roasted like gold. It is tested with red-hot gold, for adulterated material darkens, while the pure pigment keeps its colour. I find that lime also is used as an adulterant and that the fraud can be detected in a similar manner, using a plate of hot iron if gold is not available.

122. Sun and moon injure a minium paint. To prevent this, when the wall is dry, hot Punic wax melted with oil should be applied with a brush, and then heated with a brazier of oak-apple charcoal till it sweats. It is rubbed with wax candles and finished with a clean cloth, just as marble statues are polished. Minium-refiners in the factory envelope their faces with loose bladders, which enable them to see without inhaling the fatal dust. Minium finds an application also in inscriptions on rolls, and more vivid letters, even in sepulchral ornamentation, have been produced on gold and marble by its aid.

Chap. VIII. Sect. 41. **123.** Of secondary importance is the fact that we have also obtained a substitute for quicksilver — hydrargyrum, consideration of which was postponed somewhat earlier in the book. There are two methods of preparation. The minium may be triturated with vinegar in a copper mortar with a copper pestle, or else it may be put into an iron vessel inside an earthen oven and covered with a lid luted on with clay. It is then heated from beneath, and free use is made of the bellows. Then when the vapour, which condenses on the lid and combines the colour of silver with the fluidity of water, is brushed off, it divides easily into globules and the mobile drops rain down.

124. Quod cum venenum esse conveniat, omnia quæ de minio in medicinæ usu traduntur temeraria arbitror, præterquam fortassis inlito capiti ventrive sanguinem sisti, dum ne qua penetret in viscera ac volnus attingat; aliter utendum non equidem censeam.

Sect. 42. **125.** Hydrargyro argentum inauratur solum nunc prope, cum et in ærea simili modo duci debeat. Sed eadem fraus quæ in omni parte vitæ ingeniosissima est viliorem excogitavit materiam, ut docuimus.

Sect. 43. **126.** Auri argentique mentionem comitatur lapis quem coticulam appellant, quondam non solitus inveniri nisi in flumine Tmolo, ut auctor est Theophrastus, nunc vero passim; alii Heraclium, alii Lydium vocant. Sunt autem modici, quaternas uncias longitudinis binasque latitudinis non excedentes. Quod a sole fuit in his, melius quam quod a terra. His coticulis periti, cum e vena ut lima rapuerunt experi*mento ra*mentum, protinus dicunt quantum auri sit in ea, quantum argenti vel æris scripulari differentia, mirabili ratione non fallente.

Sect. 44. **127.** Argenti duæ differentiæ. Vatillis ferreis candentibus ramento imposito, quod candidum permaneat probatur; proxima bonitas rufo, nulla nigro. Sed experimento quoque fraus intervenit. Servatis in urina virorum vatillis inficitur ita ramentum obiter dum uritur candoremque mentitur. Est aliud experimentum politi et in halitu hominis, si sudet protinus nubemque discutiat.

Cap. IX. Sect. 45. **128.** Lamnas duci, speciem fieri non nisi ex

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124. *inlito*, BMay. *illito*, VRdTBrot. *inlitum*, PhSill. — *sisti*, VRdMay. *sistit*, BhPSill. *sistendum*, TBrot. — *qua*, BSill. May. *quid*, VRdhTW.

125. *ærea*, BSill. May. *æra*, hW. *æris*, VdT. *veris*, R.

126. *experimento ramentum*, Ed. (L. C. P.) *experimentum*, Mss.

127. *aliud*, dW. *aliquod*, Al. Sill. May.

128. *duci*, BVRdSill. *duci et*, hW. *duci in*, Conj. May. — *speciem*, BJan. May. *specula*, Al. Sill. — *fieri*, Mss. *vitri*, Conj. May. — *creditum*, Al. May. *credimus*, BSill. — *sed*, Mss. Sill. *est*, Conj. May. — *vi*, hW. *vis i*, B. *nisi*, VRd. *vis*, Sill. (with full-stop after *usu*). *vi sic*, Conj. May.

124. It is admittedly poisonous, and so I consider that all the old prescriptions of minium in medicine are unwise, except perhaps to check a flow of blood by smearing it on the head or abdomen, provided that it does not penetrate to any of the internal organs nor touch a wound. In all other cases I think it should be avoided.

Sect. 42. **125.** Gilding with hydrargyrum is now almost confined to silver, although it should be similarly applied to copper vessels. But the spirit of deception which shows its ingenuity in all departments of life has devised a cheaper material, as we have already explained.

Sect. 43. **126.** An account of gold and silver is incomplete without a mention of what is called the whetstone, found formerly, according to Theophrastus, only in the river Tmolus, but now known to be widely distributed. It is called by some the Heraclian, by others the Lydian stone. These stones are of moderate size, not exceeding four inches by two, and the side that was exposed to the sun is better than the side next the ground. In testing, workers skilled in the use of the whetstone take with it a scraping from an ore, as one might with a file, and can then tell straight off, to the nearest scruple, how much gold, silver, or copper it contains, by this wonderful method which never fails them.

Sect. 44. **127.** There are two points in which silver shows variations in behaviour. A filing is placed on an iron shovel which has been heated till it glows. If the filing remains bright it is accepted as pure. Second-rate silver turns red, while that which blackens has no merit. But deception has made its way into this test also. If the shovel is kept in human urine, the filing absorbs some while it is being heated and counterfeits brightness. The other test, if the specimen is polished, is to breathe on it and observe whether it fogs immediately, and easily shakes off the dew.

Chap. IX. Sect. 45. **128.** It used to be believed that thin sheets

optimo posse creditum. Fuerat id integrum, sed id quoque iam fraude corrumpitur. Sed natura mira imagines reddendi, quod repercusso aere atque in oculos regesto fieri convenit. Eadem vi, in speculi usu polita crassitudine paulumque propulsa, dilatatur in immensum magnitudo imaginum; tantum interest repercussum illum respuat an excipiat.

129. Quin etiam pocula ita figurantur, expulsis intus crebris ceu speculis, ut vel uno intuente totidem populus imaginum fiat. Excogitantur et monstrifica, ut in templo Zmyrnæ dicata. Id evenit figura materiæ. Plurimum refert concava sint et poculi modo, an parmæ Thræcidicæ, media depressa an elata, transversa an obliqua, supina an infesta, qualitate excipientis figuræ torquente venientes umbras.

130. Neque enim est aliud illa imago quam digesta claritate materiae accipientis umbra.

Atque ut omnia de speculis peraguntur in hoc loco, optima apud maiores fuerant Brundisina, stagno et ære mixtis. Prælata sunt argentea; primus fecit Pasiteles Magni Pompeii ætate. Nuper credi cœptum certiorem imaginem reddi auro opposito † aversis †.

Sect. 46. **131.** Tinguit Ægyptus argentum ut in vasis Anubim suum spectet, pingitque, non cælat argentum. Unde transit materia et ad triumphales statuas; mirumque, crescit pretium

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129. *expulsis*, BVRSill. May. *exsculptis*, dTPBrot. *excultis*, h. — *dicata*, BhSill. May. *dicta*, VRd. — *infesta*, BSill. May. *festa*, RdhP. *resta*, V. *recta*, W.

130. *claritate*, Mss. Sill. May. *claritas*, W. — *umbra*, Conj. Jan. Sill. May. *umbram*, Mss. W. — *stagno*, BVdMay. *stanno*, RhSill. — *Pasiteles*, BVdSill. May. *Passiteles*, R. *Praxiteles*, hPW. — *aversis*, Mss. ?*vitris*, Ed. ? *vitris aversis*, Prof. D'Arcy Thompson (private communication). See note.

could be drawn and images obtained only from the finest silver, but, where pure silver used to be employed, alloys have now been fraudulently introduced. Still, the property of producing an image is marvellous and must be due to the reflection of the air which is driven back to meet the eyes. By this same property, when using a mirror made from a thick plate, polished and rendered slightly concave, the dimensions of the image are greatly magnified, so much difference does it make whether the mirror rebuffs or welcomes the air on reflection. **129.** Why even goblets are so fashioned, by hammering out a number of little mirrors, so to speak, on the inner surface, that one man looking therein is reflected as a whole multitude, an image for every facet. Distorting mirrors too have been devised, such as those which are dedicated in the temple at Smyrna, the effects being produced by the shape of the surface. It makes all the difference whether they are concave like a cup or shaped like a Thracian shield [i. e. convex], whether the centre is depressed or raised, whether the oval is horizontal or oblique, whether the mirror is flat or upright. The incident shadow is twisted according to the nature of the shape of the receiving surface. **130.** For the image produced is none other than the shadow, arranged by the bright surface of the receiving substance.

To complete the present account of mirrors, we must add that the best known to our forefathers were made at Brundisium from a mixture of copper and *stagnum.* Silver ones, however, have come to be preferred since Pasiteles made the first in the time of Pompeius Magnus. I understand that the latest advance consists in obtaining a more reliable image by applying gold † to the back †.

Sect. 46. **131.** The Egyptians stain silver that they may see their favourite Anubis on their vessels, and painting takes the place of engraving. First used thus, this material is now employed

fulgoris excæcati. Id autem fit hoc modo. Miscentur argento tertiæ æris Cyprii tenuissimi quod coronarium vocant et sulphuris vivi quantum argenti. Conflantur ita in fictili circumlito argilla; modus coquendi, donec se ipsa opercula aperiant. **132.** Nigrescit et ovi indurati luteo, ut tamen aceto et creta deteratur.

Miscuit denario triumvir Antonius ferrum; miscent æra falsæ monetæ; alii *et* ponder*i* subtrahunt, cum sit iustum LXXXIV e libris signari. Igitur ars facta denarios probare, tam iucunda plebei lege ut Mario Gratidiano vicatim totas statuas dicaverit. Mirumque, in hac artium sola vitia discuntur et falsi denarii spectatur exemplar pluribusque veris denariis adulterinus emitur.

Cap. X. Sect. 47. **133.** Non erat apud antiquos numerus ultra centum milia; itaque et hodie multiplicantur hæc, ut decies centena aut sæpius dicantur. Fænus hoc fecit nummusque percussus, et sic quoque æs alienum etiamnum appellatur. Postea Divites cognominati, dummodo notum sit eum qui primus hoc cognomen acceperit decoxisse creditoribus suis. **134.** Ex eadem gente M. Crassus negabat locupletem esse ni qui reditu annuo legionem tueri posset. In agris HS |$\overline{\text{MM}}$| possedit, Quiritium post Sullam divitissimus. Nec fuit satis, nisi totum Parthorum esurisset aurum; atque ut memoriam quidem opum occupaverit, — iuvat enim insectari inexplebilem istam habendi cupidinem, — multos

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132. *et ovi*, VRdWMay. *ovi*, BhSill. — *miscent*, BVTPrSill. May. *miscentur*, RdBrot. — *alii et*, Conj. May. *aliæ*, BVJan. *alii e*, hSill. *alia*, R. *alii*, d. — *ponderi*, Conj. Urlichs, May. *pondera*, d. *pondere*, Al. Sill. — *totas*, BhSill. May. *tota*, VRdeTBrot.

134. *esurisset*, Al. W. *usurpasset*, BSill. May. — *ut*, BhSill. May. *vi*, V. *in*, RdPlTBrot. — *opum*, BSill. May. *opimum*, r. *optimo*, VRdhTP. *optimum*, lBrot. *optimi*, Dal. — *occupaverit*, BVRdhTSill. May. *occupavit*, PlBrot. — *paulo ante*, V^2 Jan. May. *paulantem*, B. *paulante*, VRd. Omit. hWSill.

for triumphal statues also, and, strange to relate, the value of the silver is enhanced when its splendour has been sullied. The preparation is as follows : — one-third of a part of the finest Cyprian copper called *coronarium* is mixed with one part of silver and the same amount of live sulphur. The whole is heated in an earthen crucible luted with clay, the operation being terminated when the lid comes off of its own accord. **132.** Silver can also be tarnished with the yolk of a hard-boiled egg, but this stain can be removed with vinegar and chalk.

The triumvir Antony adulterated the denarius with iron, and false coin contains an admixture of copper. Others make light-weight coins, although the statutory weight is eighty-four to the pound. Denarius-testing was therefore established as a regular profession by a law which was so popular that the plebs dedicated full-size statues to Marius Gratidianus in all the wards of the city. It is curious that money-testing is the only profession in which one must make a study of what is false, and a specimen of a counterfeit denarius is viewed with interest, the spurious coin being purchased at a cost of several genuine denarii.

Chap. X. Sect. 47. **133.** Our ancestors had no expression for numbers greater than one hundred thousand, so even to-day this is used as a unit for multiplication and we speak of ten times a hundred thousand or of larger multiples. This is the outcome of usury and the possession of a currency, whence also the expression " another man's money " [i. e. debt]. At a later date the cognomen " Dives " was introduced, but we must remark in passing that the first to receive this cognomen cheated his creditors by bankruptcy. **134.** M. Crassus, a member of the same family, declared that no man was rich whose annual income did not suffice for the support of a legion; the richest Roman next to Sulla, his landed property amounted to two hundred million sesterces. Nor was this enough. He must needs hunger for

postea cognovimus servitute liberatos opulentiores, pariterque tres Claudii principatu paulo ante, Callistum, Pallantem, Narcissum. **135.** Atque ut hi omittantur, tamquam adhuc rerum potiantur, C. Asinio Gallo C. Marcio Censorino coss. a. d. VI kl. Febr., C. Cæcilius C. l. Isidorus testamento suo edixit, quamvis multa bello civili perdidisset, tamen relinquere servorum quattuor milia centum sedecim, iuga boum tria milia sexcenta, reliqui pecoris CC quinquaginta septem milia, in numerato HS. $|\overline{\mathrm{DC}}|$; funerari se iussit HS. $|\overline{\mathrm{X}}|$.

136. Congerant excedentes numerum opes, quota tamen portio erunt Ptolemaei, quem Varro tradit Pompeio res gerente circa Iudæam octona milia equitum sua pecunia toleravisse, mille convivas totidem aureis potoriis, mutantem ea vasa cum ferculis, saginasse !—**137.** Quota vero ille ipse — neque enim de regibus loquor — portio fuerit Pythii Bithyni, qui platanum auream vitemque nobiles illas Dario regi donavit ! Xerxis copias, hoc est $|\overline{\mathrm{VII}}|\overline{\mathrm{LXXXVIII}}$ hominum, excepit epulo, stipendium quinque mensum frumentumque pollicitus, ut e quinque liberis in delectu, senectuti suæ unus saltem concederetur. Hunc quoque ipsum aliquis comparet Crœso regi ! Quæ, malum ! amentia est id in vita cupere quod aut et servis contigerit aut ne in regibus quidem invenerit finem !

Sect. 48. **138.** Populus Romanus stipem spargere cœpit Sp.

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135. *C. l.* (sc. *libertus*), Conj. Urlichs, May. *kl.* BV. *Claudius*, RhWSill. — $|\overline{\mathit{DC}}|$, Conj. Jan. May. *DC*, BVRd. *sexcenta milia*, h. *sexcenties*, K. — $|\overline{\mathit{X}}|$, Conj. Jan. May. *IXI*, B. $\overline{\mathit{XI}}$, VRdSill.

136. *ea vasa*, BSill. May. *vasa*, VRdhW. — *Pythii*, RSill. *Pythis*, BhUrl. May. *Pyths*, V. *Pythio*, d. *Pythiæ*, Pint.

137. *qui platanum*, VRdhWMay. *Platanum*, BSill. — *in delectu senectuti suæ*, eSill. *in dilectu senectuti suæ*, BMay. *in dilectu senectutis suæ*, d. *in dilectus senectuti suæ*, VR. *senectuti suæ in delectu*, hW.

all the gold of the Parthians, and, although he was the first to win a lasting reputation for wealth — to attack that insatiable lust for gain is always a pleasure —, we find that many freedmen have since been richer, including three simultaneously not long ago in the reign of Claudius - Callistus, Pallas, and Narcissus. **135.** Even if we omit to mention these three, as though they were still masters of the world, C. Caecilius Isidorus, freedman of Caius, on the 27th of January in the consulship of C. Asinius Gallus and C. Marcius Censorinus, proclaimed by his will that, in spite of heavy losses in the civil war, he was leaving four thousand one hundred and sixteen slaves, three thousand six hundred yoke of oxen with two hundred and fifty-seven thousand other animals, and sixty million sesterces. A million sesterces he directed to be expended on his funeral.

136. And yet, though all this boundless wealth be added together, what a small portion it will be of the wealth of Ptolemaeus ! For Varro relates that, when Pompey was operating in Judaea, Ptolemaeus supported eight thousand horsemen from his private purse, and that he feasted a thousand guests, providing each with a golden goblet and changing these vessels with every course. **137.** Yet how small even his wealth — and I do not now speak of kings — compared with that of Pythius the Bithynian, who presented that famous plane-tree and that vine of gold to King Darius ! He feasted the host of Xerxes, seven hundred and eighty-eight thousand strong, and offered pay and corn for five months if only, of his five sons in the levies, one at least be spared to him in his old age. Once more, could he be compared with King Croesus ?

A plague on it ! What madness it is to desire that in life which even slaves have possessed, and of which even kings could never get enough !

Sect. 48. **138.** It was in the consulship of Sp. Postumius and

Postumio Q. Marcio coss.. Tanta abundantia pecuniæ erat ut eam conferret L. Scipioni, ex qua is ludos fecit; nam quod Agrippæ Menenio sextantes æris in funus contulit, honoris id necessitatisque propter paupertatem Agrippæ, non largitionis esse duxerim.

Cap. XI. Sect. 49. **139.** Vasa ex argento mire inconstantia humani ingenii variat nullum genus officinæ diu probando. Nunc Furniana, nunc Clodiana, nunc Gratiana, — etenim tabernas mensis adoptamus, — nunc anaglypta asperitatemque, exciso circa linearum picturas, quærimus. **140.** Iam vero et mensas repositoriis imponimus ad sustinenda opsonia; interradimus alia, ut quam plurimum lima perdiderit. Vasa coquinaria ex argento fieri Calvus orator quiritat, at nos carruchas argento cælare invenimus, nostraque ætate Poppæa coniunx Neronis principis soleas delicatioribus iumentis suis ex auro quoque induere iussit.

Sect. 50. **141.** Triginta duo libras argenti Africanus sequens heredi reliquit idemque, cum de Pœnis triumpharet, $\overline{\text{IIII}}$ CCCLXX pondo transtulit. Hoc argenti tota Carthago habuit, illa terrarum æmula, quot mensarum postea apparatu victa! Numantia quidem deleta idem Africanus in triumpho militibus X VII dedit. O viros illo imperatore dignos, quibus hoc satis fuit! Frater eius Allobrogicus primus omnium pondo mille habuit, at Drusus Livius in tribunatu plebei X.

142. Nam propter quinque pondo notatum a censoribus trium-

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139. *exciso*, BRSill. May. *excisa*, VdhW.

140. *alia ut*, BSill. May. *aliud*, RdP. *latera aliud*, V. *altera et interest*, h. *latera et interest*, W. — *carruchas*, BSill. (who compares καρούχα), Url. *carrucas*, Al. WMay. — *iussit*, BSill. May. *solebat*, hDal. Om. Al. Brot.

141. *triumpho militibus*, Al. WMay. *triumpho*, BSill. — *plebei*, BSill. May. *plebis*, Al. W.

Q. Marcius that the Roman people began to make voluntary contributions. Money was so plentiful that they subscribed it to L. Scipio, who spent it in celebrating games. The contribution of copper sextantes for the funeral of Agrippa Menenius I am inclined to consider a mark, not of prodigality, but rather of respect, and one that was rendered necessary by the poverty of Agrippa.

Chap. XI. Sect. 49. **139.** Marvellous are the changing fashions in silver plate produced by our fickle fancy, which bestows its approval on no one make for long. Now we want Furnian plate, now Clodian, now Gratian — for the very shops figure on our tables, — now the roughened surface of embossed silver, where the metal has been cut away along the painted lines.

140. In these days we even poise upon our *repositoria* (sideboards) table-tops [of silver] for supporting viands. In other articles we rasp away the silver between the figures — the more the file destroys, the better. The orator Calvus complains about kitchen utensils made of silver, but ours the invention of covering carriages with silver chasings, and in our generation too did Poppaea, consort of the Emperor Nero, order the more delicate of her mules to be shod with gold.

Sect. 50. **141.** The younger Africanus bequeathed to his heir thirty-two pounds of silver, and the amount which he displayed in his triumph over the Carthaginians was four thousand, three hundred and seventy pounds. This was all the silver possessed by the whole of Carthage, that rival of ours in empire — how many tables have since surpassed her by the splendour of their decorations! The same Africanus, when he triumphed after the destruction of Numantia, gave his troops seven denarii apiece. O soldiers worthy of such a general, to be satisfied with that! His brother, Allobrogicus, was the first to possess a thousand pounds of silver, but Livius Drusus, when tribune of the plebs, had ten thousand pounds.

142. It now seems to us like a legend that an aged general,

phalem senem fabulosum iam videtur; item Catum Ælium, cum legati Ætolorum in consulatu prandentem in fictilibus adissent, missa ab iis vasa argentea non accepisse neque aliud habuisse argenti ad supremum vitæ diem quam duo pocula quæ L. Paulus socer ei ob virtutem, devicto Perseo rege, donavisset. **143.** Invenimus legatos Carthaginiensium dixisse nullos hominum inter sese benignius vivere quam Romanos; eodem enim argento apud omnes cenitavisse ipsos. At Hercules, Pompeium Paulinum, Arelatensis equitis Romani filium paternaque gente pellitum, $\overline{\text{XII}}$ pondo argenti habuisse apud exercitum ferocissimis gentibus oppositum scimus; (Sect. 51. **144.**) lectos vero iam pridem mulierum totos operiri argento, quædam et triclinia, quibus argentum addidisse primus traditur Carvilius Pollio eques Romanus, non ut operiret aut Deliaca specie faceret, sed Punicana. Eadem et aureos fecit, nec multo post argentei Deliacos imitati sunt. Quæ omnia expiavit bellum civile Sullanum.

Sect. 52. **145.** Paulo enim ante hæc facta sunt lancesque e centenis libris argenti, quas tunc super CL numero fuisse Romæ constat multosque ob eas proscriptos dolo concupiscentium. Erubescant annales qui bellum civile illud talibus vitiis imputavere. Nostra ætas fortior fuit : Claudii principatu servus eius Drusilianus nomine Rotundus, dispensator Hispaniæ citerioris, quingenariam lancem habuit, cui fabricandæ officina prius exædificata fuerat, et comites eius octo ad CCL libras, quæso, ut quam multi eas conservi eius inferrent aut quibus cenantibus !

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143. *pellitum*, BVRdTSill. May. *pulsum*, hDal. *adpellatum*, l. — *$\overline{XII}$*, BSill. May. *XII*, VRdhW.

145. *facta*, VRdhSill. *factæ*, BPUrl. May. — *lancesque*, VRdhSill. *lances quæ*, P. *lances*, BUrl. May. — *Drusilianus*, BVRUrl. May. *Drusillanus*, hdSill. — *ad CCL libras*, BSillMay. *DCCCL librarum*, VdBrot. *DCCCL libras*, RT. *LVIII libras*, Pr. *quinquaginta octavo librarum*, h. — *conservi eius*, VRdMay. *conserviens*, B^1. *conservis*, B^2. *conservi*, hSill.

who had been honoured by a triumph, was stigmatised by the censors for possessing five pounds of silver; or again that Catus Aelius, when the ambassadors of the Aetolians who came to interview him as consul had found him breakfasting off earthenware, refused to accept the silver vessels sent by them, and that he possessed no silver to the day of his death except two cups given him by his father-in-law, L. Paulus, for his valour during the conquest of King Perseus.

143. We have read the statement of the Carthaginian ambassadors that no men live together more harmoniously than the Romans, for in every house the silver service off which they dined was the same. But, by Hercules, we know that Pompeius Paulinus, son of a Roman knight of Arelate, and coming of a race which had been clad in skins, brought with him twelve thousand pounds of silver, even when campaigning against the most savage tribes.

Sect. 51. **144.** We know too that ladies' couches have long been plated with silver from end to end. Some banqueting couches also have been thus decorated, in the first instance, according to tradition, by Carvilius Pollio, a Roman knight. He, however, did not cover them all over, and made 'Punic' couches rather than ' Delian ' ones. The gold couches which he made were of the same kind, but soon came silver couches which followed the ' Delian ' fashion. All such vanity was paid for in blood during the civil war of Sulla. Sect. 52. **145.** For these articles were made shortly before the war, and at the same period were made silver dishes weighing a hundred pounds apiece, of which we know there were more than a hundred and fifty in Rome at that time, and that many were proscribed for their sake through the treachery of those who coveted them. The very annals should blush, which have attributed that civil war to vices such as these.

Our age went one better. In the reign of Claudius, one of his slaves named Drusilianus Rotundus, his steward in Hither

146. Cornelius Nepos tradit ante Sullæ victoriam duo tantum triclinia Romæ fuisse argentea, repositoriis argentum addi sua memoria cœptum. Fenestella, qui obiit novissimo Tiberii Cæsaris principatu, ait et testudinea tum in usum venisse, ante se autem paulo lignea, rotunda, solida, nec multo maiora quam mensas fuisse, se quidem puero quadrata et compacta aut acere operta aut citro cœpisse, mox additum argentum in angulos lineasque per commissuras; tympana vero se iuvene appellata, tum a stateris et lances quas antiqui magides vocaverant.

Sect. 53. **147.** Nec copia argenti tantum furit vita sed valdius pæne manipretiis, idque iam pridem, ut ignoscamus nobis. Delphinos quinis [milibus] sestertiis in libras emptos C. Gracchus habuit, Lucius vero Crassus orator duos scyphos Mentoris artificis manu cælatos sestertiis C; confessus tamen est nunquam iis uti propter verecundiam ausum; sci*mus* eundem HS. $\overline{VI}$ in singulas libras vasa empta habuisse.

148. Asia primum devicta luxuriam misit in Italiam, siquidem Lucius Scipio in triumpho transtulit argenti cælati pondo MCCCC et vasorum aureorum pondo MD, anno conditæ urbis DLXV;

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146. *ait et*, BSill. May. *sed et*, VRhW. *sed*, dT. — *appellata tum a stateris*, BSill. May. *appellatum stateris*, V. *appellatum a stateris*, R. *appellata stateres*, d. *appellata rumateras*, h. *appellata stateras*, W. — *magides*, Al. Sill. May. *magidas*, VW. *magiras*, h.

147. *sestertiis*, Mss. Sill. Jan. *sestertium*, Hard. Url. May. — *C*, Sill. Jan. $\overline{C}$, Url. Detl. May. — *scimus*, Conj. May. *sicut*, Mss. Sill. *constat*, W. *scitum*, Conj. Jan.

148. *anno conditæ urbis DLXV*, Al. W. *at n*, B^1. *at*, B^2 Sill. Jan Mayhoff brackets *anno... DLXV*.

Spain, had a dish weighing five hundred pounds, for the manufacture of which a special workshop was built, and eight companion pieces weighing as much as two hundred and fifty pounds apiece, to be carried in, pray, by how many of his fellow-slaves, or for what dinner-party?

146. We learn from Cornelius Nepos that there were only two silver banqueting-couches at Rome before the victory of Sulla, and that the ornamentation of *repositoria* (sideboards) with silver began within his memory. Fenestella, who died towards the end of the reign of Tiberius Caesar, adds that *repositoria* covered with tortoise-shell had come into fashion at that time. Just before his day, those in use had been made from a solid round of wood, and were not much bigger than tables, but in his boyhood square ones with inset pieces, or veneered with maple or citrus-wood, began to come in, and soon silver ornamentation was affixed at the corners and along the joins. In his youth they were known as *tympana*, and later these articles, which had been called *magides* by the ancients, were termed *lances* from their resemblance to the pan of a balance.

Sect. 53. **147.** Workmanship almost more than mere quantity of silver is madly desired by society ,and we may find some excuse for ourselves in reflecting that this has long been the case. C. Gracchus had " dolphins " which cost five thousand sesterces a pound. Moreover, Lucius Crassus the orator had two cups engraved by the hand of the artist Mentor, which cost one hundred thousand sesterces, and yet he admitted that he was afraid ever to use them. We know that the same man had vessels purchased for six thousand sesterces a pound.

148. It was the conquest of Asia that first introduced luxury into Italy, for Lucius Scipio displayed in his triumph fourteen hundred pounds weight of engraved silver and fifteen hundred

eadem Asia donata multo etiam gravius afflixit mores inutiliorque victoria illa hereditas Attalo rege mortuo fuit. **149.** Tum enim hæc emendi Romæ in auctionibus regiis verecundia exempta est, urbis anno DCXXII, mediis LVII annis erudita civitate amare etiam, non solum admirari, opulentiam externam, immenso et Achaicæ victoriæ momento ad impellendos mores, quæ et ipsa in hoc intervallo, anno urbis DCVIII, parta signa et tabulas pictas invexit, ne quid deesset; (**150.**) pariterque luxuria nata est et Carthago sublata, ita congruentibus fatis ut et liberet amplecti vitia et liceret. Petiere et dignationem hinc aliqui veterum. C. Marius post victoriam Cimbricam cantharis potasse Liberi patris exemplo traditur, ille arator Arpinas et manipularis imperator.

Cap. XII. Sect. 54. **151.** Argenti usum in statuas primum divi Augusti temporum adulatione transisse falso existimatur; iam enim triumpho Magni Pompeii reperimus translatam Pharnacis qui primus regnavit in Ponto argenteam statuam, item Mithridatis Eupatoris et currus aureos argenteosque. Argentum succedit aliquando et auro, luxu feminarum plebis compedes sibi ex eo facientium, quas induere aureas mos tritior vetet. **152.** Vidimus et ipsi Arellium Fuscum, motum equestri ordine ob insignem calumniam cum celebritatem adsectarentur adolescentium scholæ, argenteos anulos habentem. Et quid hæc attinet colligere, cum

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149. *regiis,* RhWUrl. May. *regis,* BVdSill. May. — *invexit, ne quid deesset; pariterque*... Mayhoff conjectures *quoque* for *-que* and reads *invexit. Ne quid deesset, pariter quoque*...

151. *ex eo,* VdhW. Omit. BSill. May.

152. *celebritatem,* BSill. May. *celebritate,* VRdhrW. — *catellis,* Gron. BSill. May. *catillis,* Al. Brot. *batillis,* Barbarus, Dal.

pounds weight of gold vessels, in the five hundred and sixty-fifth year of the city. When this same Asia was presented to Rome it inflicted a much more serious injury on the national character, and the legacy of dead king Attalus was still less profitable than the victory just mentioned. **149.** For all restraint in purchasing such objects was cast aside during the auctions of the king's treasures in the six hundred and twenty-second year of the city. During the fifty-seven years that had intervened, the citizens had learned, not merely to admire, but to desire foreign opulence. The ruin of our character was accelerated enormously during this interval by the victory over Achaia, which, that nothing might be lacking, had caused an influx of captured statues and pictures in the six hundred and eighth year of the city. **150.** Thus the birth of luxury coincided with the destruction of Carthage, and the fates conspired to make the opportunity to embrace vice simultaneous with the temptation. Some of our ancestors sought similar methods of enhancing their reputation. C. Marius is said to have drunk from a cantharus, in imitation of father Liber, after his victory over the Cimbri — Marius, a ploughman from Arpinum, a ranker with the *imperium*.

Chap. XII. Sect. 54. **151.** The usual impression, that silver was first used for statues in the case of the Emperor Augustus during that age of flattery, is incorrect, for we find that a silver statue of the first Pharnaces to reign in Pontus was displayed in the triumph of Pompeius Magnus, with one of Mithridates Eupator and chariots of gold and silver.

Silver sometimes takes the place even of gold, through the extravagances of women of the lower order who make of it anklets for themselves, since fashion forbids the antiquated use of gold anklets. **152.** We have seen with our own eyes rings of silver worn by Aurellius Fuscus who was removed from the equestrian order by means of a notorious false accusation just when his reputation was drawing young men to his lectures in great numbers.

capuli militum, ebore etiam fastidito, cælentur argento, vaginæ catellis, baltea lamnis crepitent; iam vero pædagogia in transitu virilitatis custodiantur argento, feminæ laventur et, nisi argentea, solia fastidiant, eademque materia et cibis et probris serviat.

153. Videret hæc Fabricius et stratas argento mulierum balineas ita ut vestigio locus non sit, cum viris lavantium, Fabricius qui bellicosos imperatores plus quam pateram et salinum habere ex argento vetabat, videret hinc dona fortium fieri aut in hæc frangi! Heu mores! Fabricius nos pudet.

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(Par. 154-157 on *Cælatura* are included in ‘ The Elder Pliny's Chapters on the History of Art ’, edited by Jex Blake and Sellers.)

157. * * * * * * * * * *

Argentum medicatis aquis inficitur atque etiam afflatu salso, sic *et* in mediterraneis Hispaniæ.

Sect. 56. **158.** In argenti et auri metallis nascuntur etiamnum pigmenta, sil et cæruleum. Sil proprie limus est. Optimum ex eo quod Atticum vocatur; pretium in pondo libras X II. Proximum marmorosum dimidio Attici pretio. Tertium genus est pressum quod alii Scyricum vocant ex insula Scyro; (**159.**) iam et ex Achaia, quo utuntur ad picturæ umbras; pretium in libras HS bini. Dupondiis vero detractis, quod lucidum vocant, e Gallia veniens; hoc autem et Attico ad lumina utuntur, ad abacos non nisi marmoroso, quoniam marmor in eo resistit amaritudini calcis. Effoditur et ad XX ab urbe lapidem in montibus. **160.** Postea uritur, pressum appellantibus qui adulterant; sed esse

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157. *sic et,* Conj. Desaint Edn. *sicut,* Mss. Sill. May.

158. *Scyricum,* hSill. May. *Styricum,* BVRd. *Syricum,* Brot. — *Scyro,* hSill. May. *Styro,* B. *Syro,* Brot. *Tyro,* VRd.

160. *Scyrico,* Sill. May. *Styrico,* BVRd. *Syrico,* hBrot. — *obmutuit,* hSill. Jan. *ommutuit,* BVDetl. *ommitunt,* d. *omittunt,* RBrot. May.

But what boots it to collect these examples when soldiers, despising ivory, have the hilts of their swords chased in silver, while their scabbards ring with silver chains and their belts with silver plaques. Why, even the continence of our page-boys is guaranteed with silver, women use it for their ablutions and scorn a bath if it is not of that metal, and the same material is employed for table use and for the most degrading purposes.

153. Would that Fabricius could see these things, and the baths, where women bathe with men, so strewn with silver that there is not room to set one's foot — Fabricius, who forbade gallant generals to have more than a cup and a salt-cellar of silver, — would that he could see the rewards for valour now made from that metal, or broken up to make such articles as we have mentioned above! Alas for our degenerate character! Fabricius puts us to shame.

157. * * * * * * * * * *

Silver is tarnished by medicinal waters and also by salt breezes, as happens in Spain, even in places far from the coast.

Sect. 56. **158.** In silver-mines and gold-mines the pigments sil and caeruleum also occur. Sil is, strictly speaking, a mud. The best variety is made from the Attic mineral and costs two denarii a lb. The next, the 'marbled' sil, is half the price of the Attic. The third is the 'dark' variety which others call Scyrian from the island of Scyros. **159.** It now comes from Achaia also and is used for the dark parts of pictures. The price is two sesterces a lb. The so-called 'clear' kind, coming from Gaul, costs two asses less and, like the Attic kind, is employed for high lights. For wall-panels, only the 'marbled' variety is used, since the marble in it withstands the bitterness of the lime. It is mined also in the mountains at the twentieth mile-stone from the city. **160.** It is subsequently burned and the dishonest manufacturers say that it is the 'dark' variety, but its counterfeit nature, and the fact that it has been burned, are revealed

falsum exustumque amaritudine apparet et quoniam resolutum in pulverem est.

Sect. 57. Sile pingere instituere primi Polygnotus et Micon, Attico dumtaxat. Secuta ætas hoc ad lumina usa est, ad umbras autem Scyrico et Lydio. Lydium Sardibus emebatur, quod nunc obmutuit.

Cap. XIII. **161.** Cæruleum harena est. Huius genera tria fuere antiquitus: Ægyptium, maxime probatum; Scythicum, — hoc diluitur facile et, cum teritur, in quattuor colores mutatur, candidiorem nigrioremve et crassiorem tenuioremve; — præfertur huic etiamnum Cyprium. Accessit his Puteolanum et Hispaniense, harena ibi confici cœpta. Tinguitur autem omne et in sua coquitur herba bibitque sucum. **162.** Reliqua confectura eadem quæ chrysocollæ. Ex cæruleo fit quod vocatur lomentum; perficitur id lavando terendoque. Hoc est cæruleo candidius; pretia eius X x in libras, cærulei X VIII. Usus in creta, calcis impatiens. Nuper accessit et Vestorianum ab auctore appellatum; fit ex Ægyptii levissima parte; pretium eius X XI in libras. Idem et Puteolani usus præterque ad fenestras; cylon vocant.

163. Non pridem adportari et Indicum cœptum est, cuius pretium X VII. Ratio in pictura ad incisuras, hoc est, umbras dividendas ab lumine. Est et vilissimum genus lomenti quod tritum vocant, quinis assibus æstimatum.

Cærulei sinceri experimentum in carbone ut flagret; fraus, viola arida decocta in aqua, sucoque per linteum expresso in cretam

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161. *hoc diluitur*, Mss. Sill. *mox diluitur*, Conj. May.

162. *X XI in libras*, Brot. *in libras XI*, B. *XI*, VRdT. *XI lib.*, p. *XL in libras*, h. *XI in libras*, Dal. *X I*, Gron. Hard. Sill. May.

163. *causticis. Teritur autem difficillime. Sil*, May. Sillig and the earlier editors read *causticis. Teritur autem difficillime sil*;.

by its bitterness and the way in which it has been reduced to powder.

Sect. 57. Polygnotus and Micon were the first artists to use sil, but only Attic sil. Their successors used Attic for high lights, Scyrian and Lydian for the shaded parts. Lydian sil used to be purchased at Sardis, but the demand has now failed.

Chap. XIII. **161.** Caeruleum is a hard substance. Three varieties have long been known — the Egyptian, which is considered to be the best, the Scythian, which is easily disintegrated in water, and on grinding yields four shades of colour, the lighter, the darker, the coarser, and the finer, and the Cyprian which is, however, superior to the Scythian. To these we may now add varieties from Puteoli and from Spain, where deposits are being worked for the first time. All kinds are dyed, and absorb the colour when boiled with the appropriate herb. **162.** The rest of the preparation is identical with that of chrysocolla.

What we call *lomentum* is made from caeruleum, and prepared for use by washing and grinding. It is lighter in tint than caeruleum and costs ten denarii a lb., while caeruleum costs eight. It can be used on a background of chalk, but is injured by lime. A kind recently introduced is the Vestorian *lomentum*, so called from its inventor. This is made from the lightest part of the Egyptian caeruleum, and sold for eleven denarii a lb. The caeruleum from Puteoli is used, under the name of *cylon*, for similar purposes, but is also employed for windows.

163. The importation of *caeruleum Indicum*, at seven denarii a lb., is a recent development. It is used in painting for *incisuræ*, that is, the divisions between light and shade. Finally, there is the cheapest kind of *lomentum*, the so-called ‘ ground ’ variety, priced at five asses a lb.

The test for pure caeruleum is that it should burn on a hot coal. It is imitated by boiling dried pansies with water, and straining the extract through a cloth into Eretrian earth. It is used in medicine for cleaning ulcers, and so it has become an ingre-

Eretriam. Vis in medicina, ut purget ulcera; itaque et emplastris adiciunt, item causticis, teritur autem difficillime.

164. Sil in medendo leniter mordet adstringitque et explet ulcera. Uritur in fictilibus, ut prosit.

Pretia rerum, quæ usquam posuimus, non ignoramus alia aliis locis esse et omnibus pæne mutari annis, prout navigatione constiterint, aut ut quisque mercatus sit, aut aliquis prævalens manceps annonam flagellet, non obliti Demetrium a tota Seplasia Neronis principatu accusatum apud consules. Poni tamen necessarium fuit quæ plerumque erant Romæ, ut exprimeretur auctoritas rerum.

dient of plasters and cauteries, although the task of powdering it is not easy.

164. The therapeutic properties of sil are those of a gentle mordant and astringent, and it induces the filling in of ulcers. It is prepared for use by ignition in earthen vessels.

We are well aware that all the prices which we have inserted are subject to local fluctuations and are rarely the same from year to year, being dependent on shipping and wholesale trade, or the cornering of the market by some commercial magnate. For we have not forgotten Demetrius, who was accused before the consuls by the whole Seplasia in the reign of Nero. It was, nevertheless, necessary to state the average prices at Rome, so that the standard value of commodities might be available.

NOTES

235. *Samosata.* On the western shore of the Euphrates, capital of Commagene (in northern Syria), the present Samosat. Cf. H. N. 5, 85-6. See note on '*oppugnante Lucullo*' below.

Maltham. Deposits of hydrocarbon mixtures occur naturally in many parts of the world. These vary from mobile oils such as those which, after refining, provide motor spirit, to pitchy solids such as bitumen and asphalt. The fluidity depends on the nature of the hydrocarbons present. *Maltha* was evidently a semi-solid variety, very much like what we call pitch, and was, of course, entirely different from the artificial *maltha* mentioned in H. N. 36, 181. *Naphtha* was a more fluid variety, perhaps what we should now call 'crude petroleum'.

Oppugnante Lucullo. Dio Cassius (Frag. ex Xiph. p. 76, ed. Reimar.) relates that Lucullus and his soldiers were attacked with *naphtha* when besieging Tigranocerta in 69 B. C. Pliny is clearly mistaken in speaking of the siege of Samosata, for Commagene gave in without fighting (Dio Cass. 36, 2.) The soldiers of Severus suffered similar treatment at the hands of the Atreni (Dio Cass. 75, 11). Cf. fragmentary reference in Sallust (Hist. 4, 61. Maurenbrecher).

aquis accenditur. This does not mean that *maltha* was 'set on fire by water', as Bostock and Riley translated. That *accendere* can mean 'to heat', as well as 'to kindle', is clear from H. N. 33, 94 and 123. See note on these passages.

naphthæ. See on *maltham* above.

Astacenis. A territory, mentioned by Isidorus Characenus in his *Mansiones Parthicæ*, and lying between Hyrcania and Parthia.

bituminis. See H. N. 35, 178-182, also references in 5, 71f and 7,65.

corona igne rapta. Most editors quote Hor. (Epod. 5, 65), where the robe is said to have caught fire, and Apuleius (Met. 1, 7), '*flammis coronalibus deusserat*', as examples of opposite traditions. It seems clear, however, from Euripides (Medea, 1186ff), that the chaplet caught fire first, and that the flames then seized upon the robe.

125. *Purpuræ.* The *purpura* of Pliny is probably the modern *murex brandaris*, while the *buccinum* mentioned later is probably the shell-fish now called *purpura hæmastroma.* There are, however, many shell-fish which produce red and purple colours, and Pliny's names may really cover a number of different molluscs.

annis... septenis. Aristotle (Hist. Anim. 5, 15, 547b, 9) says six years. Pliny follows closely throughout the account given by Aristotle in Hist. Anim. 5, 15 (references to the Editio Borussica, 1831).

plurimum. 'at the most' (cf. H. N. 25, 54; 30, 48), rather than 'mostly', as Bostock and Riley translate.

latent... circa canis ortum. Cf. Arist. Hist. Anim. 5, 15, 547a, 14. The dog-star rose about the beginning of July.

congregantur... salivant. Most shell-fish envelope their eggs with a clear, gelatinous substance, which, though not waxy to the touch, is not unlike a honeycomb in appearance. Cf. Aristotle, Hist. Anim., 5, 15, 546b, 18ff.

florem. A translation of ἄνθος, the word used by Aristotle (Hist. Anim. 5, 15, 547a, 15).

tinguendis expetitum vestibus. The famous Tyrian purple has been the object of several investigations in modern times. The actual substance as it occurs in the shell-fish has a white colour, but on exposure to sunlight it gradually acquires, first a greenish hue (v. *glauco* in par. 127) and then a blue colour, and finally becomes a deep purple red (cf. account of colours produced by heating, Poll. 1, 4, 2). Under the microscope, the colour is seen to change directly from white to purple, so that the development of green and blue shades has probably a physical rather than a chemical explanation.

The chemical nature of the purple dyestuff was investigated by P. Friedlander, who came to the conclusion that the principal coloured constituent was 6 : 6′ —dibromindigo, although another coloured constituent was also present in smaller quantity. This latter body has not yet been identified. For a full account of the investigations carried out, the reader should consult 'Synthetic Colouring Matters — Vat Colours' (Thorpe and Ingold, 1923), part I, chapter II.

Hardouin quotes the story related by Cassiodorus (Var. I, 2), that the dye was first discovered when a hungry dog on the Tyrian shore attacked some shellfish and in so doing stained its jaws purple. Julius Pollux (1, 4, 2) tells the same story, but says that the dog belonged to a nymph Tyros, who was wandering by the sea with her lover Hercules. For Hercules, Achilles Tatius (2, 11) substitutes a shepherd. This latter derivation of the name Tyrian need hardly be seriously considered.

Like all valuable substances, Tyrian purple was imitated. Cf. '*Spondet enim Tyrio stlattaria purpura filo*', Juv. 7, 134.

126. *Vivas capere contendunt.* Cf. Aristotle, Hist. Anim. 5, 15, p. 547a, 26.

minores cum testa vivas frangunt. Cf. Aristotle, Hist. Anim. 5, 15, p. 547a, 21, and Vitruvius, 7, 13, 3.

127. *Tyri... Laconica.* Cf. H. N. 35, 45, '*Tyrium aut Gætulicum vel Laconicum, unde pretiosissimæ purpuræ*'.

Meninge. Meninx was an island off the coast of Africa, near the Lesser Syrtis. See H. N. 5, 41.

Gætulo litore. In what is now Morocco. *Oceani* shows that the West coast was intended.

Laconica. More usually *Laconia*. *Laconica* is a transliteration of the Greek *Λακωνική*.

Huic fasces... viam faciunt. Making way, that is, for Roman consuls wearing the *toga prætexta*.

pro maiestate pueritiæ. Freeborn children wore the purple-bordered *toga prætexta* till they assumed the *toga virilis*.

Distinguit ab equite curiam. Cf. H. N. 33, 29. The senators wore the tunic with the *latus clavus*, the equites that with the *angustus clavus*.

dis advocatur placandis. Hardouin compares Cicero, Att., 2, 9, '*Vatinii strumam sacerdotii διβάφῳ vestiant*'. Dalechamps and Ajasson think that there is a reference to sacrifices made by purple-clad consuls.

in triumphali miscetur auro. In the *toga picta* of the triumphing general. Cf. H. N. 8, 195, '*pictas vestes iam apud Homerum fuisse, unde triumphales natæ*'.

unde conchyliis pretia. Bostock and Riley translate as if *conchylia* were the same as *purpuræ*. The passages that follow show clearly that a contrast is intended between the Tyrian purple described in par. 135 and the conchylian colour of par. 138.

virus grave. A highly offensive odour is developed during the extraction of the dye-stuff from the molluscs which produce it, a circumstance which has undoubtedly diminished the number of modern investigators of the colour.

austerus in glauco. The editor has been unable to find a parallel for this curious expression. The original reading may have been '*color austerus, et glauco et irascenti similis mari*'.

128. *Lingua purpuræ.* Aristotle also remarks that the tongue of the purple is longer than a finger (Hist. Anim. 5, 15, p. 547b, 6). The purple, like many other shell-fish, has a long tongue, called a *radula*, covered with a large number of minute teeth.

perforando... conchylia. Cf. Arist., Part. Anim. 2, 17, p. 661a, 21. The *Purpura lapillus* can pierce the shell of the mussel, *Mytilus edulis*, in about two days' time by its powerful *radula* (Molluscs and Brachiopods, Cooke, Shipley, and Reed, 1913, p. 60).

Aquæ dulcedine necantur. Cf. Arist., Hist. Anim. 8, 20, p. 603a, 13.

vivunt saliva sua. According to Aristotle (loc. cit.), they 'live on one another' for fifty days.

129. *Præmia vitæ.* Hardouin notes the expression '*pretia vivendi*' used with a similar sense by the younger Pliny (Ep. 1,12). Cf. also '*pretium victoriae*', Tac. Agric. 12,6.

eadem enim... temperamento. Bostock and Riley, not realising the difference between *purpuras* and *conchylia* (see note on par. 128), translate 'the elements in both (sc. *genera concharum*) are the same; the combinations only are different'. The phrase however means that the purple and the conchylian colours differ in the way in which the extracts from the two kinds of shell-fish are mixed for dyeing.

Buccinum. Corresponds to the modern *purpura*, which, as described in the following paragraph, has no spines on the shell.

rotunditate oris in margine incisa. A notch at one side of the opening is a well-marked feature in most shell-fish of this type.

130. *purpura..., canaliculato procurrente rostro.* The *purpura* corresponds to the modern *murex*. The *rostrum canaliculatum* is a projecting spine, sometimes of considerable length, with a deep groove from end to end. It has nothing to do with the tongue, but encloses the 'branchial siphon', a development of the mantle surface which conducts water necessary for respiration to the branchia.

clavatum est ad turbinem. The *Muricidæ* are well furnished with spines, some set upon the *rostrum canaliculatum* of the preceding paragraph, some arranged in rings on the whorls of the shell. There are usually six spines to the ring. Mosso (Palaces of Crete, VI, IX) remarks that Cretan vases have been found which show molluscs with seven spines.

orbes totidem quot habeant annos. Cf. Arist. (Hist. Anim. 5, 15, p. 547b, 10). « The deposition of shell is not continuous. Rest periods occur, during which the function is dormant; the periods are marked off on the edge of the shell, and are known as 'lines of growth'. In some cases (e.g. *Murex*), the rest period is marked by a decisive thickening of the lip, which persists on the surface of the shell as what is called a ‘ varix ’ » (Molluscs and Brachiopods, Cooke, Shipley; and Reed, 1913, p. 256).

131. *lutense.* For this and following terms, I have used the translations of Bostock and Riley, ‘ mud-purple ’, ‘ pebble-purple ’, etc.

tæniis. Cf. H. N. 3, 4.

calculense. Possibly the *Purpura lapillus*, whose shell, banded with black and white, bears a strong resemblance to certain stones and rocks.

dialutense. The context makes it probable that the word was connected, in Pliny's mind at least, with διαλυτός, free or roving, the derivation adopted by Bostock and Riley. Other derivations have been suggested, e.g. ‘ half-buried in the mud ’ (Lewis and Short), from *lutum*, mud.

132. *Ita pendentes... purpuræ tolluntur.* It seems unlikely that this was the routine method employed, when such large numbers of shellfish were necessary, but there is no doubt that such a method is theoretically possible. Instances are on record in which birds, rats, and even coyotes have been caught and held fast by limpets (Molluscs and Brachiopods, Cooke, Shipley, and Reed —1913, p. 57). Aelian (De Animal. 7, 34) and Oppian (Hal. 5, 600 ff) give similar accounts of the catching of purples. Cf. also H. N. 32, 50.

133. *post canis ortum.* See note on par. 125.

cum cerificavere. Cf. Arist., Hist. Anim. 5, 15, p. 547a, 20. See note on par. 125.

salem. Added to minimise putrefaction.

sextarios. A *sextarius* was about a pint.

fervere in plumbo. Bostock and Riley translate *plumbum* by ‘ tin ’, remarking that Pliny uses *plumbum* in this sense. There are a few doubtful cases where *plumbum*, standing alone, might possibly refer to tin, but in the majority of cases where the word is used without addition of *nigrum* or *album*, lead is clearly intended. J. F. Thorpe and C. K. Ingold (Vat Colours, 1923, p. 10) find no chemical difficulty in the fact that the liquid was boiled down in leaden vessels. Mosso (Palaces of Crete, VI, IX) discovered lead-lined cists in the magazines of Knossos, which, he thinks, may have been used for the preparation of the dye. With whole account, cf. Poll. 1, 41, 2.

singulas aquæ amphoras... æquali. Mayhoff's reading is here adopted as the best yet suggested for this very difficult passage. It must, however, be admitted that the introduction of *centenas* into the text lacks explanation.

134. *elutriatum.* Mainly to remove grease.

ebibat saniem. As Tyrian purple is a ‘ vat colour ’ of the indigo type, that part of it which was actually utilised as a dye-stuff must have been taken up by the fibres in the colourless, soluble form, before the action of sunlight had completed the change to the coloured, insoluble form.

The lack of fastness of '*buccinum per se*' may have been due to allowing the change to go too far, and it is noteworthy that, in the process recommended in par. 135, the raw and unheated extract, which would contain a high percentage of the original, colourless, soluble form, was employed.

The Romans may, of course, have known some way of transforming the insoluble purple dibromindigo into its soluble reduction product, but if so, no record of such knowledge has survived.

cocci. See note on Bk. 33, 114.

135. *Summa medicaminum —in L libras.* The meaning is uncertain, and the passage, as it now stands, is hardly grammatical. Mayhoff considers that something has been lost. The figure before *libras* is missing in all mss., and has been variously replaced. Hardouin conjectures that *L* fell out before *libras*, and this seems to be the best suggestion yet made, but none can be regarded as certain.

CX. The manuscript reading *CXI* may be correct, but Hardouin is probably right in supposing that the *I* crept in from the following *Ita*. The odd figure *CXI* seems unlikely.

amethysti. For the gem, see H. N. 37, 121. For *amethystina*, cf. Juv. 7, 135, '*purpura vendit Causidicum, vendunt amethystina*'.

suspectu refulgens. The way in which sunlight brings out the brilliance of the purple has been noted by Philostratus (Imagg. I, 28, p. 804), Pollux (I, 4, 2), and Aristotle (De Color. 2, 792a, 15).

Homero purpureus dicitur sanguis. Iliad 17, 360 f. Most authorities have followed Scaliger in assuming that the purple dye was unknown in Homeric times, and Scaliger points out that any bright colour was πορφύρεος to the ancients, quoting πορφυρᾶν Ἀφροδίτην (Anacreon), '*purpureos ramos*' (Catullus), '*purpureis oloribus*' (Horace), etc. Though this is undoubtedly true, the frequent use in Homer (Il. 3, 126; 8, 221; 9, 200; 24, 645, Od. 4, 115) of πορφύρεος as an epithet to describe the appearance of linen clothes, etc., makes it probable that a definite colour, perhaps the shell-fish purple, is intended.

136. *trabea.* The *trabea* worn by the early kings was like a *toga*, with horizontal purple stripes. There was also an all-purple *trabea*, sacred to the gods.

toga prætexta. A *toga* with a purple stripe running along the edge, worn by curule magistrates, the higher order of priests, and freeborn boys and girls.

latiore clavo. The broad purple stripe on the *toga* of those of senatorial rank.

Tullum Hostilium. Reigned 673-642 B. C.

Nepos Cornelius. See note on Book 33, 146.

rubra Tarentina. Hardouin stated that, according to the Tarentines of his time, remains of old workshops and huge heaps of shells still existed. Similar heaps at Palaikastro are taken by Mosso (Palaces of Crete VI, IX) to prove that purple was prepared in Crete two thousand years B. C., before the advent of the Phœnicians to the Mediterranean.

137. *dibapha.* i.e. ' twice-dipped '. There are many references to this expensive colour. Cf. Ovid, A. A., 3, 170, ' *nec quæ bis Tyrio murice lana rubet* ', Mart. 4, 4, 6, etc.

triclinaria. Cf. H. N. 8, 196.

DCXCI. The mss. all read *DC*, though no date in Roman history is more certain than that of the consulship of Cicero. The loss of the figures *XCI* illustrates the extraordinary extent to which numbers are often mutilated in the manuscripts.

138. *pro indiviso.* Bostock and Riley translate ' is mixed with water and urine *in equal parts* '. *Pro indiviso* can hardly have this definite meaning. In H. N. 16, 137; 17, 1; 18, 53, it means simply ' in common '. This is the way the words were taken by Salmasius (ad Tertull. Pall., ed. 1622, p. 141) to mean ' *lotio et aqua simul iunctis, nec certa mensura divisis* '. Hardouin preferred the reading ' *pro inviso* '.

humani potus excremento. Cf. ' *potus hominum* ', (H. N. 17, 51) used similarly.

quinquagenos. Salmasius conjectured *quingentos*, remarking ' *buccinum longe purpura vilius* '. The general tone of the preceding passage is certainly in agreement with this view. The prices of the raw dyestuff should be contrasted with those asked for the finished article in pars. 136 and 137.

139. *adulterare adulteria naturæ.* It is hard, at first sight, to see how these words apply to *testudines tinguere*, but perhaps the *testudo* itself, when used for ornamental purposes, and thus diverted from its natural use as a protection for the animal, was regarded as an *adulterium naturæ*.

In the later instance, the mixing of silver and gold was the *adulterium naturæ*, the addition of copper was the second falsification.

testudines tinguere. Cf. H. N. 16, 233, ' *nuper portentosis ingeniis principatu Neronis inventum ut pigmentis perderet se plurisque veniret imitata lignum* '. For other instances of use of tortoise-shell for decoration, see H. N. 9, 39.

electra. Cf. H. N. 33, 80f.

Corinthia. For this triple alloy, cf. H. N. 34, 5-8 and 37, 49, ' *in Corinthiis æs placet argento auroque mixtum* '. Corinthian bronze was one of the famous metals of antiquity, and was used for making expensive dishes, ornaments, etc.

ut sit ex utroque improbum nomen. Hardouin and Ajasson suppose this name to be *Tyriamethystus*, a word which is added (a conjecture, of course) in K. This word is found nowhere else, and it seems quite likely that the name was *Tyrianthinus* (from *Tyrius* and ἄνθος or *flos*), a word found in Martial 1, 54, 5.

Dr. L. C. Purser has suggested to me that *improbum* implies a play on *amethystus* and μέθυ, wine, from which Pliny rather fancifully derives the word (H. N. 37, 121).

140. *Color alius operiretur alio.* Archil (*fucus marinus*) was similarly used as a groundwork for conchylian colour (H. N. 26, 103). Archil is also mentioned H. N. 13, 136; 32, 66.

hysginum. The Greek ὕσγινον, a dye properly prepared from the shrub ὕσγη.

141. *Coccum.* Called by Dioscorides κόκκος βαφική. Its occurrence on the ilex is described in H. N. 16, 32. See note on H. N. 33, 114.

Emeritam. The modern Merida.

Lusitaniæ. See on Book 33, 78.

47. *duo genera.* The other plant, mentioned in par. 48, was *radicula* (probably soapwort).

rubia. The madder plant has been known from very early times, and is still cultivated widely, although the dye extracted from it is being gradually ousted by the synthetic manufacture of its most important ingredient, alizarin, or 1, 2-dihydroxyanthraquinone. This occurs in the madder root as ruberythric acid, which is easily hydrolysed to glucose and alizarin. Madder also contains some purpurin, or 1, 2, 4-trihydroxyanthraquinone.

Dioscorides gives an account of madder (3, 160), and Herodotus (4, 189) says that Libyan women wore goat-skins dyed with it. Pliny mentions it again in Bk. 24, 94.

Italica. Dioscorides (loc. cit.) mentions madder from Ravenna.

omnes pæne provinciæ. Madder has been grown in modern times in most parts of Europe, particularly in France.

seriturque similitudine ervilïæ. This is, of course, an alternative to '*sponte provenit*', as is also clear from Diosc. 3, 160. It has been generally remarked that there is little similarity between the vetch and the madder plant.

spinosis foliis et caule. Most mss. read *spinosis et caule*, which was early emended to *spinosus ei caulis.* Mayhoff is probably right in inserting *foliis.* There are considerable variations in the leaves and stem of *Rubia tinctorum.* Some leaves have very pronounced barbs round the edge, while some are practically smooth. The size of the spines on the stems also varies greatly.

quinis... foliis. The plant has, as a rule, either four or six leaves round the joints of the stem.

semen eius rubrum, radix rubra est. All mss. read *Semen eius rubia est.* Sillig quotes the passage from Dioscorides (3, 160, given incorrectly by Sillig and Mayhoff as 3, 150), 'the fruit is round, green at first, then red, becoming black as it ripens', an accurate description, and thinks that part of the sentence as written by Pliny has been lost. He reads *semen eius rubrum est*, and suggests that the original may have been *semen eius viride, tum rubrum, postremo nigrum est. Rubia quos...* Mayhoff reads *semen eius rubrum, postremo nigrum, radix rubra est.* There seems no reason to suppose that Pliny gave exactly the same facts as Dioscorides. Where both authors follow the same authority, Dioscorides frequently gives a much more explicit account than Pliny. The reading of the present edition, an abbreviation of Mayhoff's conjecture, could easily have given rise to the manuscript reading. It preserves the most valuable feature of Mayhoff's suggestion, the mention of the important *radix* from which the dye is derived, and the omission of the fact that the berries finally turn black is quite in keeping with Pliny's frequent inaccuracy. He may never have seen a madder plant, and may have simply picked out what he considered the salient facts mentioned by his authority.

Suo loco. H. N. 24, 94.

MISCELLANEOUS DYESTUFFS. A number of brief references to natural dyestuffs are scattered through the Historia Naturalis. For the most part, they merely record the existence of the substances, and give no chemical information. In addition to the passages concerning indigo, kermes, madder, purple, and weld, dealt with in this edition, the principal references are : — *Coccus ilicis* (kermes) 16, 32; 22, 3 (cf. 9, 141); *crocum* (saffron) 21, 31 ff: *flos balaustium* (pomegranate flower) 13, 113; *fucus marinus* (archil) 13, 136; 26, 103; 32, 66; *gallæ* (gall-nuts) 16, 26; *genistæ* (broom) 16, 74; *glastum* (woad) 22, 2; *hyacinthus* (for *hysginum*) 21, 170; *lutum* (weld) 21, 46 (cf. 33, 87); *nuces iuglandes* (walnut) 15, 87; *vaccinium* (? whortleberry) 16, 77.

The reason for the paucity of information about dyeing processes is to be found in H. N. 22, 4, where Pliny says '*nec tinguendi tamen rationem omisissemus, si umquam ea liberalium artium fuisset*'.

73. *Sal.* Common salt (sodium chloride) had many uses in antiquity, and references to it may be found in most books of the *Historia Naturalis.* Several interesting observations occur in the earlier sections of Book XXXI. For example, in par. 67, Pliny states that four *sextarii* of water will dissolve one *sextarius* of salt and no more. This is surely one of the earliest estimates of solubility. The actual solubility of salt is 35.5 in 100 at 0°C. Again, in par. 70 we find methods for obtaining fresh water from salt water by filtration through earth and by a very primitive form of distillation.

aut fit aut gignitur. Ajasson condemns the word *fit* as incorrect, because the salt of the ancients was not made by any such process as the addition of sodium sulphate to calcium chloride. Such criticism is beside the point. In Pliny's terminology, any substance which did not occur ready for use, had to be ' made ', and *fit*, which simply indicates the hand of man, is probably best translated by ' prepared '.

coacto umore vel siccato. Hardouin is doubtless right in supposing that *coacto* refers to salt deposited underground, while *siccato* refers to the evaporation of moisture on the surface, mainly by solar heat. With *coacto* compare *umore densato* (par. 77). Pliny may have imagined that water condensed to salt as it solidifies to ice.

Tarentino. At Tarentum in Calabria. See par. 84-6.

Cocanicus. A lake near the mouth of the river Durillo, on the south coast of Sicily. See par. 80.

Gelam. On the south coast of Sicily. See par. 86.

Cappadocia. In Asia Minor, north of Cilicia.

Aspendi. In Pamphylia. Cf. H. N. 5, 96.

ad medium. Ad medium lacum, the reading of Sillig, would seem to mean that the lake dried up entirely. The *tantum* of the previous clause shows that this was not the case.

74. *tantundem nocte subvenit quantum die auferas.* Ajasson explains that the rivers flowing into the lake are continually replacing the salt which is removed, and Bostock and Riley accept this explanation. A comparison with pars. 77 and 78 shows that Pliny's ideas on the recurrence of salt were totally unscientific. In the case of these dried up lakes, the salt would be removed from a part of the lake which was not under water, and to which salt could not be added in the manner described by Ajasson till the winter rains had once more raised the lake to its original level. The statement is an example of Pliny's love for the miraculous. That such a legend was common is proved by a comparison with Cato ap. Gellium, N. A., 2, 22, '*in his regionibus mons ex sale mero magnus; quantum demas, tantum adcrescit.*'

spuma... relicta. Ajasson remarks that salt, which is used for saturating sea-water in the salterns, is collected on the shore at Avranches.

sole densatur. Pontedera's conjecture is rendered probable by '*sole decocta*' of Isidor. XVI, 2, 3., which he quotes.

75. *duo lacus.* It is hardly profitable to spend much time on the identification of these lakes. Possible identifications are given by Ajasson.

summa fluminum densantur in salem, amne reliquo veluti sub gelu fluente. Another example of the credulity shown by Pliny throughout the whole passage. Ajasson, while rejecting the second part of the phrase as an exaggeration, accepts the first as indicating a surface film of salt. Bostock and Riley's only comment is 'In consequence of the extreme heat'. It is incredible that a surface film of salt could be formed on the surface of flowing water, though it would, of course, be possible, in a small salt pool, or an artificial tank.

The story may have arisen from salt deposited on reeds and grasses at the edge of a river. This would give an appearance similar to that of ice, which often remains at the edges long after mid-stream ice has disappeared. Vitruvius (8, 3, 7) notes that salt rivers are those which flow through salt-bearing lands.

Caspias portas. A pass in Mt. Taurus, leading from Media into Hyrcania and Parthia. See H. N. 6, 40-45.

Mardos. See H. N. 6, 16, 47.

76. *Ochus et Oxus.* The Ochus, a tributary of the Oxus, is said to be the modern Herat. Cf. H. N. 6, 48. The Oxus is probably the modern Jihon, which rises on the borders of Hyrcania and Sogdiana and flows to the Caspian Sea.

his adpositis. Most editors omit *his*, possibly because they have not realised that it refers to *Ochus et Oxus.* Sillig rightly retains the word.

Pagasæi. Pagasa was the maritime town in Thessaly where the Argo was built. Cf. H. N. 4, 29. Also called Pagasæ.

77. *renascens.* See note on par. 74.

Effoditur et e terra. Most of the salt of modern times is thus obtained, enormous deposits being found at Stassfurt and other places (see article on Salt in Encyclopædia Britannica).

umore densato. Cf. *coacto umore* (par. 73).

specularium lapidum modo. Lapis specularis is used to indicate at least two substances — mica and gypsum. Here, as in H. N. 36, 183, it is a variety of gypsum. At Stassfurt large deposits of gypsum are found close to those of rock salt.

micas. Literally 'crumbs' or 'grains'.

78. *Gerrhis... muros domosque massis salis faciunt.* The same information is given by Strabo (16, 3, p. 766), and Pliny (H. N. 6, 147) says '*Gerra... turres habet ex salis quadratis molibus*'. Cf. H. N. 5, 34, and Solinus 28, 1, where we read that the Amantes did the same.

aqua feruminantes. On pressing together two blocks of salt with water between, the salt at first dissolves until a saturated solution is formed. On evaporation the salt is deposited on both surfaces and eventually unites them together.

Pelusium. Damietta, in Egypt.

detractis harenis. This may mean that the salt was under the sand. Another explanation is that the salt was removed from the sand by washing, and the solution afterwards evaporated.

crescens cum luna. See note on par. 74. This belief may be connected with the belief of the ancients that the moon was the source of moisture. Cf. H. N. 2, 223; 20, 1. See further Frazer's 'Golden Bough' VI, ch. 8 & 9.

Hammoniaco. Many early commentators assumed that the *sal Hammoniacus* of the ancients (e.g. Herod. 4, 181 ff.) was the 'sal ammoniac' (ammonium chloride) of the moderns. The more enlightened writers have long taken the view that it was a variety of common salt (sodium chloride). This is the conclusion of Beckmann (Hist. Inv. II, 396ff., a masterly passage), and of Stillman (History of Early Chemistry, p. 48). Arrian (Exped. Alex. 3, p. 108, Ed. Gron.) speaks of it as ordinary salt, used in sacrifices as being cleaner than sea salt, and Apicius (1, 27 — '*salis hammoniaci fricti*') speaks of it as being roasted before use. 'Sal ammoniac' would be volatilised by this treatment. Dioscorides (5, 126) mentions, among other varieties of salt, 'the Ammoniacal, which can be easily broken, with rectilinear cleavage'. Columella (De R. R. 6, 17, 7) speaks of rock salt as being Spanish, Ammoniacal, and Cappadocian. The Encyclopædia Britannica states that 'sal ammoniac' has been found native in Bucharia, but that there is no evidence that it occurs in any part of Cyrenaica. In fine, we have no proof that the words *sal Hammoniacus* were used of ammonium chloride before the tenth century A. D.

According to Blümner (Pauly-Wissova IA2, p. 2087), the salt found in the desert, near the site of the temple of Jupiter Ammon, contains only 10-20% sodium chloride, the rest being mainly gypsum.

79. *alumini quod schiston vocant.* See on Bk. 33, 86 & 88.

rectis scissuris. Cf. Diosc. 5, 126. Rock salt often occurs in cleavable masses.

vix credibili pondere ingravescat. This points clearly to the hygroscopic nature of rock salt. Pure sodium chloride does not attract water, but magnesium and calcium chlorides, with which it is commonly contaminated, are very hygroscopic. Beckmann (Hist. Inv. II, 399) remarks that this phenomenon of increase in weight is often evident in the salt-mines of Wieliczka. Pliny's explanation, that it is buoyed up by the vapour in the mines as an object is buoyed up by water, and therefore appears to weigh less than its real weight, is of course fantastic.

80. *Cocanicum.* Cf. par 73.

Egelestæ. According to Ajasson, the famous mountain of rock salt at Cardona, in Catalonia.

locus... sterilis est. True, unless the quantity of salt is very small.

sal sponte nascens... Facticii. In obelising *intra haec* and reading as I have done, I have assumed that the words *sponte nascens* were early displaced from the position indicated by Man. Dal., and that the words *intra haec* were introduced in an attempt to make sense. The phrase, as given by the mss., seems too awkward to be correct, even in Pliny.

81. *imbre maxime iuvante.* Cf. H. N. 2, 233, *Pluvias salinis aquas utiliores esse... nec fieri salem nisi admixtis dulcibus*'; also H. N. 34, 125, '*fit et salis modo, flagrantissimo sole admissas dulces aquas cogente*'. The reason for adding fresh water is far from clear. If added to the salt water before evaporation, as this passage seems to suggest, it would simply increase the time necessary for the latter operation. In fact salterns are often provided with covers for use during rain. Probably the sea-water was first evaporated, and the crude salt was then treated with a limited amount of fresh water, which dissolved by preference the deliquescent magnesium chloride, a purer salt being thus obtained. Rain-water would be preferable to spring-water, as containing less dissolved solids.

induruere. Thompson (Chemistry of the Ancient Assyrians, sect. 8) quotes Bacon as saying that ashes of Kali, found in the desert between Alexandria and Rosetta, were compressed into masses like stones, and sold to the Venetians for glass-making.

sucosum. Cf. par. 109.

82. *in bitumen liquidum cogitur.* Oil and salt are frequently associated in nature.

Chaonia. In the north-west of Epirus. For this spring, see Arist. Met. 2, 3, 359a, 24-35 (Ed. Borussica).

inertem. No doubt other salts besides sodium chloride were deposited.

ardentibus lignis. You would get thus a mixture of salt, ashes, and alkaline salts, which could hardly be very palatable (Cf. Beckmann, Hist. Inv., II, p. 493).

83. *e puteis.* i.e. wells sunk into or in the neighbourhood of salt deposits.

per se cinere sincero vim salis reddat. Varro (R. R. 1, 7, 8), when speaking of salt as a manure, says, '*ubi salem nec fossitium nec maritimum haberent, sed ex quibusdam lignis combustis, carbonibus salsis pro eo uterentur*'. The wood ashes would contain potash, which is a useful fertilizer. Theophrastus (3, 7, 6) mentions oak-wood as a source of λίτρον (*nitrum*).

Theophrastum. As Sillig remarks, Theophrastus, the disciple and successor of Aristotle, drew from Arist. Met. 3, 359b, 2-4 (Ed. Borussica).

Umbros. ἐν Ὀμβρικοῖς (Arist., loc. cit.). Most editors think these the same as the *Umbræ*, an Indian race (H. N. 6, 76). The reference may equally well be to the people of Umbria.

decoquere aqua. Perhaps an extraction of soluble salts. The insoluble ashes would be removed by decantation, and the solution then evaporated.

e menis. Many medical uses of these salted fish are given in Bk. 32.

84. *Marinorum.* Dioscorides (5, 126) mentions the same varieties of salt.

Salamine. A city of Cyprus (H. N. 5, 130).

Tarentinus. Cf. par. 73.

Tattæus. Cf. H. N. 31, 99. Strabo (12, 5, p. 568) describes the salt lake of Tatta (the modern Tuzla).

Magis tamen extendit is quem Citium appellavimus. Cf. par. 75, and H. N. 32, 65, '*cutem mulierum extendit*'.

melanthio. See on H. N. 33, 85.

85. *salsissimus sal qui siccissimus.* Pure salt is not hygroscopic. Impure salt, which would presumably be less salty, usually contains deliquescent impurities.

Pluvia dulcescit omnis. This is probably a reference to 'salt losing its savour' (St. Luke, 14, 34). When crude salt is left for use on the land or for animals, rain would wash out the salt, leaving behind the earthy impurities.

copiosum aquilonis flatus. Blümner (Pauly-Wissowa, IA2, p. 2077) recognised that Pliny refers to the fact that the north wind was dry, the south wind wet. Evaporation would be brisker in a dry wind. Cf. Isidor. Nat. Rer. 37, '*aquilo... gelidus atque siccus et sine pluvia*', and Gell. 2, 22, 14, '*Latine auster, Græce νότος nominatur, quoniam est nebulosus atque umectus*', also H. N. 18, 328-9.

Flos salis. v. note on par. 90.

In igne nec crepitat nec exsilit Tragasæus nec Acanthius. Aristotle (Problem. 11, 42) remarked that large-grained salt crackled more than small-grained because it was harder to break up the grains. The phenomenon seems to be mainly due to the presence of water, the evaporation of which causes the decrepitation. Dry, fine salt does not crackle.

For Tragasæan salt, see also Strabo, 13, 1, p. 605, and Galen 12, p. 372, Ed. Kühn.

Agrigentinus ignium patiens, ex aqua exsilit. This story is found also in Isidor. 16, 2, 4 ('*flammis patiens, in aqua exilit*'), and 14, 6, 34, Solinus, Polyhist. 5, 18. ('*salem Agrigentinum si igni iunxeris, dissolvitur ustione; cui si liquor aquæ proximaverit, crepitat veluti torreatur*'), and Augustine, Civ. Dei, 21, 5, 1.

Two explanations seem possible. *Sal Agrigentinus* may have been a name erroneously applied to lime from that district. Alternatively, a manuscript error may be responsible for the difficulty. Meursius (ad Antig. Caryst. 183) suggested '*ignis impatiens*', a conjecture universally rejected on account of the passages quoted above. If, however, the error were early introduced into the text of Pliny, it would probably be slavishly copied by the later writers. Perhaps the true reading was, '*ignis impatiens est atque exsilit*'.

86. *colorum differentiæ.* Rock-salt, as found to-day, is often coloured by impurities. Isidore (16, 2, 5) gives almost the same list.

rubet... rufus. The difference implied between the two colours is uncertain. *Ruber* and *rufus* are both used of blood.

Memphi. See par. 75.

Oxum See par. 76.

Centuripis. In Sicily, near Ætna.

Gelam. See par. 73.

Tarentinum. See pars. 73, 84, and 85.

spumeum. See par. 74.

Tragasæum. See par. 85.

Bæticum. Bætica, in Southern Spain, corresponds mainly to the modern Andalusia.

87. *garo.* A fish-sauce. See H. N. 31, 93-4.

88. *pecudes... sale maxime sollicitantur*, ff. Cf. Aristotle, Hist. Anim. 8, 10, 596a, 16-26 (Ed. Borussica); Vergil, Georgics, 3, 394-7; etc.

voluptates quoque animi sales. The mss. read '*voluptates animi quoque nimia sales*', and the meaningless *nimia* has been variously emended (see critical notes). I believe the corruption to have arisen as follows. The original reading was that which appears in the text. *Animi* was accidentally transcribed as *nimia*, by transposition of the letter *a*, so that the reading became '*voluptates quoque nimia sales*'. The need of some word 'mind' being felt, and the error passing unrecognised, *animi* was reintroduced in a different place.

sales. A very common use in Latin literature. The high value set on salt is indicated by other ways also in which the word was used, e.g. 'Ye are the salt of the earth' (St. Matthew, 5, 13).

89. *Honoribus... militiæque.* Cf. Juv. 7, 88, '*militiæ... largitur honorem*'.

salariis. Sc. *argentis* — originally salt-money allowed to soldiers.

salariæ viæ. This road began at the Colline Gate, and was so called because the Sabines had obtained permission to use it for the import of salt (v. Verrius Flaccus ap. Festum, s. v. *Salaria*).

modios $\overline{VI}$ *in congiario*. The *congiarium* was originally a gift distributed by *congii* (a measure equal to six *sextarii* or nearly six pints). The *modius* equalled sixteen *sextarii*.

proverbio. The proverb referred to is not known. It was apparently a reference to simple and wholesome food (cf. H. N. 31, 102 and Hor. Sat. 2, 2, 17).

mola salsa. It was customary to strew victims with coarsely ground meal, mixed with salt. Cf. H. N. 18, 7, Horace, Odes, 3, 23, 20, and many other references in literature.

90. *differentiam*. Cf. '*argenti duæ differentiæ*', H. N. 33, 127.

flos salis. The identity of this mysterious substance is quite uncertain, and indeed there were several substances called by the same name.

Dioscorides (5, 109) gives an account of ἄνθος ἁλός which is almost identical with that of Pliny. Galen (12, p. 347, Ed. Kühn) speaks of it as a moist drug, more finely-divided than roasted salt, with a bitter taste, and used as a diaphoretic . He mentions it also in 11, p. 109 and 19, p. 724, speaking of it as a simple and naturally-occurring drug. It seems possible that he was referring to the same substance as Pliny and Dioscorides.

Cato (R. R. 88) gives the name *flos salis* to ordinary salt obtained by crystallisation from brine (no doubt that referred to in par. 85).

Again, the term ἁλιανθές is used of a dyestuff. Paulus Silentiarius uses it of red dye derived from shell-fish (Anth. Pal. 5, 228, 3), and Antipater of Thessalonica (Anth. Pal. 7, 705, 5) uses the expression ἁλιανθὲς τρῦχος of a precious red rag. Similarly, Antipater of Sidon (Anth. Pal. 6, 206, 3) speaks of a head-dress dyed with 'flower of the sea'. Cf. also Anth. Pal. 7, 207, on the same subject . These passages remind us at once of the use of ἄνθος by Aristotle to indicate the purple juice extracted from the *murex*, and the reference is, no doubt, to the same or to a similar substance.

Coming back to the substance mentioned by Pliny, we find that Beckmann (Hist. Inv. II, p. 402, Bohn) rejects the conjecture of Schröder that *flos salis* is equivalent to *flores salis ammoniaci martiales*, i.e. the double chloride of iron and ammonium, and also, though less contemptuously, the identification with spermaceti suggested by Cordus.

It is clear that *flos salis* was of an oily nature from the facts that it floated on water and was soluble in olive oil. The name suggests that it was an exudation found near salt deposits. Pliny seems dubious about the belief that it comes down the Nile (*videtur*), and it is possible that this was a popular story about an oil of totally different origin, known only to Pliny in the form in which it arrived at Rome, an oil imported in jars (*vasis*) from Egypt, the surface having either become covered by a white efflorescence, or been bleached by slow atmospheric oxidation (*canitia*). This latter phenomenon is observable when most oils or fats (e.g. butter fat) are kept for some time. Oil production in Egypt is described in the papyrus about « The Revenue Laws of Ptolemy Philadelphus », published by Mahaffy and Grenfell, to which my attention has been drawn by Dr. J. G. Smyly (to whom I am also indebted for the references from the Anthology). The principal oils discussed are sesame, croton, colocynth, and linseed oils, adulteration of which with animal fats was forbidden. Petroleum fields exist beneath Lake Albert, one of the main reservoirs of the Nile, and successful borings have been made in the bed of the Kafu, a tributary of the Victoria Nile. Leaks from these or similar sources may have given rise to patches of oil floating down the Nile, an oil probably quite different from that sold as 'flos salis', but confused with it by the inexpert.

It is probably waste of time to attempt any further identification of this substance. Blümner (Pauly-Wissowa, IA2, p. 2088) identifies it with soda, which seems impossible.

Reference to the use of *flos salis* in unguents is found in H. N. 13, 9, 14.

91. *in sale pinguitudo*. The notion may have been originally derived from the association in Nature of salt with oily material (cf. par. 82), or from the fact that sweat is salt. In the main, however, Pliny's statement is a repetition of a groundless legend. Plutarch (Symp., qu. 9) says that sea-water is λιπαρός (oily, fat) because it cannot be used for washing, having first defined λιπαρός as an adjective referring to things not easily washed! He quotes Aristotle's authority for saying that a lamp burns better if you sprinkle the flame with salt-water. The latter writer not only says that salt water does not extinguish a flame like fresh water (Problem. 23, 7), but that oil may be extracted from salt (do. 23, 15), and that sea-water may be burnt (ἡ θάλαττα μόνον τῶν ὑδάτων κάεται, τὰ δε πότιμα καὶ ποτάμια οὔ — do. 23, 32). This latter statement must be taken literally, for there seems to be no evidence that καίω can, like *accendo*, mean 'to warm' (see note on Bk. 33, 123).

unguentarii. Cf. note on *flos salis* (par. 90).

Canitia. Cf. note on *flos salis* (par. 90).

92. *acopis*. Medicaments to relieve weariness (ἄκοπον). They were clearly of the nature of liniments or embrocations, 'good for the muscles' ('*acopa utilia nervis*' — Celsus, 5, 24). Cf. H. N. 23, 89, 157; 29, 55, 115; 31, 105; 32, 140; 36 ,152.

smegmatis. This form, here due to conjecture, is found in par. 105. (Greek nouns in —*ma* usually have the ablative in —*matis*. See Neue-

Wagener, 1, p. 439.) For *smegma*, cf. H. N. 22, 156; 24, 43. Jan and Mayhoff conjecture *smecticis*, which may be right (cf. *smectica vi*, H. N. 30, 29), but Dioscorides (loc. cit.) has σμήγμασι.

salsugo. Brine from the salt-mines.

106. *nitri*. The identity of *nitrum* has long been a controversial matter. Not only is it obvious that the *nitrum* of the ancients was often very impure (cf. par. 111), but it is probable that the active constituent was not always the same.

The early editors, such as Hardouin and Ajasson, followed the line of least resistance, and identified it with nitre or saltpetre, potassium nitrate. (Soda nitre, or Chili saltpetre, is sodium nitrate). Most later writers, however, are agreed that, at least in many cases, *nitrum* was a carbonate or bicarbonate of sodium or potassium (see Beckmann, Hist. Inv. II, pp. 482 ff., to whose admirable article the writer is much indebted).

Potassium nitrate occurs in small quantities in many warm countries where organic matter decays in the soil (as in cattle yards and stables, and round insanitary villages in India, Persia, etc.), and may appear as a white efflorescence. 'Bengal saltpetre' is mainly potassium nitrate. Calcium nitrate occurs similarly. Ajasson remarks that potassium nitrate is found in Egypt, at Mount Ptou-Ampihosem (quoting Andréossy), and its occurrence in Egypt is mentioned in the Dictionary of Applied Chemistry (IV, p. 364, edn. 1913).

Sodium carbonate ('soda') is found much more abundantly in nature, efflorescing from the soil here and there in hot countries, generally mixed with sodium chloride. In Egypt, large quantities of 'trona' ($Na_2CO_3.NaHCO_3.2H_2O$) are found on the shores of the natron lakes of Egypt. Potassium carbonate ('pot-ashes') has long been obtained from the ashes of plants, which contain about 30% of this salt (cf. par. 107). Herbivorous animals, like sheep, exude the potash of their diet as an oily sweat ('suint') from which the potash is sometimes recovered after shearing. With reference to the *aquæ nitrosæ* of Pliny, Beckmann remarks that waters containing saltpetre in solution are very rare, while alkaline liquids are fairly common. Bostock and Riley note that the mineral waters of Seltzer and Carlsbad, and the volcanic springs of Iceland, contain sodium carbonate.

There are a few cases in which the identification of *nitrum* with nitre seems not impossible. *Halmyrax* (par. 106) suggests the efflorescing nitre mentioned above. The account of running the Nile into *nitrum* pits, evidently with subsequent evaporation of the solution (par. 109), reminds one of leaching nitre from a nitre-bed. The theory that *spuma nitri* was formed '*acervorum fermento*' (par.112) suggests formation of nitre by nitrification from decaying organic matter. Again, in H. N. 19, 84, 143, we have references to the manuring of radishes and cabbage in the ground with *nitrum*, which may have been nitre, though the latter passage also mentions the use, for keeping cabbage green during cooking, of a *nitrum* which must surely have been soda. The fact that potassium and sodium nitrates are excellent artificial fertilizers should not make us too convinced that the passages above quoted have reference to them. Pliny (H. N. 18, 157) refers to the lines of Virgil (G. 1, 193f), '*Semina vidi equidem multos medicare serentes, Et nitro prius et nigra perfundere amurga*', and Beckmann remarks that this and other instances of steeping seeds in *nitrum* were probably due to the belief that plants grown from such seeds would be greener and softer on boiling, just as if soda were added at the time of cooking. The addition of *nitrum* to the soil may have been made with similar intention. In fact, though a number of cases has been mentioned, in which *nitrum* may have referred to nitre, it is possible that the material was soda in every case.

On the other hand, a large number of instances is available in which *nitrum* unquestionably means soda or potash. We may mention its uses in glass-making (H. N. 36, 191, 194), dyeing (par. 110), baking bread (par. 115), making meat tender (Plut, Symp. 6, 10, end), though much *nitrum* bleaches and disimproves meat (par. 115), and making vegetables green (par. 115). An alkali is indicated by the fact that it attacks shoe-leather (par. 115), and a carbonate by its effervescence with vinegar (Beckmann quotes Prov. 25, 20 '*acetum in nitro, qui cantat carmina cordi pessimo*', and Jerome's comment, '*acetum quippe si mittatur in nitrum, protinus ebullit*'.)

The Greek λίτρον or νίτρον was the same substance. Herodotus (2, 86, 87) describes its use in embalming (see note on par. 111), and there are references to its employment as a detergent. The careless husband in Theocritus (15, 16) forgot to bring home νίτρον, no doubt for use as soap. Palmer brilliantly conjectured *nitri* (soda for soap) for *matri* in Plautus, Truc. 5, 10 (Hermathena, 1882, 8, p. 258).

There are several references to the heating of *nitrum*. Galen (De Simpl. Med. Fac. 9, 18) (Ed. Kühn, 12, p. 225) says that νίτρον on roasting approaches more closely to ἀφρονίτρον, and becomes finer in the grain, and Dioscorides (5, 131) also mentions it. Beckmann remarks that the deflagration of saltpetre could hardly have failed to be noticed. Saltpetre deflagrates if heated directly with charcoal, and, if heated by itself, first decrepitates, losing mechanically entangled water, and finally gives off oxygen. Soda, on the other hand, is rendered slightly caustic by strong heating, and becomes deliquescent (cf. par. 113 & 114), and it is interesting to note that Galen (loc. cit.) remarks that ἀφρονίτρον (*spuma nitri*), to which νίτρον becomes similar on heating, must be swallowed only in cases of dire necessity, as it is bad for the stomach. This would certainly be true of partly causticised soda. Further information about the properties of *nitrum* will be found in the notes to the following paragraphs.

non multum a sale distans. Cf. Isidore, 16, 2, 7.

Theophrasto. This account does not appear in his extant works.

Exiguum... minus. Ajasson took these words to refer to the size of the particles. In this he was surely mistaken?

halmyraga. i.e. salt bursting forth from the ground.

107. *quercu cremata.* Cf. par. 83 and note.

aquæ... nitrosæ. No doubt, alkaline waters. See note on *nitri* (par. 106)

sine viribus densandi. The amount of *nitrum* deposited on concentration would be very small.

Clitis. Hardouin conjectured *Litis* from H. N. 4, 36, but the manuscripts of that book read *Lete.*

Chalastricum. Chalastra was a city of Macedonia on the Thermaean gulf. Cf. H. N. 4, 36 and 31, 115. Herodotus (7, 123) calls it *Χαλέστρη*.

proximum sali. Cf. par. 106.

novenis diebus ff. These precise details of time need hardly be taken seriously.

108. *lacum neque augeri nec effluere.* There was, no doubt, an underground outlet.

si fuere imbres, salsius nitrum. The meaning of this is obscure.

109. *lapidosum.* Cf. par. 110 & 111.

Fit pæne eodem modo quo sal. Pliny's account seems to suggest that, as *sal* came from sea-water, so *nitrum* came from Nile-water. The following statement, '*si et imbres adfuerunt, minus e flumine addunt*', shows that the *nitrum* was leached out of the ground rather than introduced in the water of the river.

Hæc. Sillig, in a note on H. N. 29, 124, considers that the nominative feminine plural of *hic* in Pliny is *haec*, not *hae.*

ut in Macedonia statis. Cf. par. 107. *Statæ febres* were 'intermittent fevers' (H. N. 28, 107).

110. *olei natura.* The soapy feeling experienced when the hands are rubbed with soda and water was probably responsible for this phrase. It has at least as much foundation as '*in sale pinguitudo*' (H. N. 31, 91).

in acervis durat. Bostock and Riley translate *durat* — 'keeps for a very considerable time'. But surely this is another reference to the phenomenon described in par. 111, by the words '*lapidescit ibi in acervis*'? For *durare* used intransitively in this sense, cf. Virg. B. 6, 35, '*Tum durare solum... coeperit*, and H. N. 14, 37. '*Vino minime durante, uva maxime*'.

lacu Ascanio. A lake in Bithynia, near Nicæa (H. N. 5, 148). Aristotle (*περὶ θαυμ. ἀκουσμ.* 53, 834a, 31, Ed. Borussica) remarks that its waters were so ' nitrous ' (νιτρῶδες) that they could be used for washing without any soap.

Chalcida. There were at least three towns of this name, in Eubœa (H. N. 4, 64), in Syria (H. N. 5, 81), and in Arabia (H. N.6, 159) respectively. The capital of Eubœa is certainly intended here, as it was much more famous than the others. If, therefore, the Syrian or Arabian town were meant, the fact would have been mentioned.

sordidum. Cf. par. 106.

ad inficiendas purpuras tincturasque omnes. Many natural red dyestuffs are insoluble or almost insoluble in water, but readily in alkaline solutions. These include madder, alkanet, and kermes. For the latter, cf. Plut., De Orac. Defectu 7, 704, Ed. Reiske. It is possible also that in many cases the crude soda would contain impurities, such as alumina, which would act as mordants.

vitro. Cf. H. N. 36, 191-4.

111. *Naucratim.* In the Delta of Egypt (H. N. 5, 64).

Memphim. Fourteen miles south of Cairo, the ancient citadel of the kings of Egypt (H. N. 5, 50).

lapidescit ibi in acervis. The ' trona ', or native soda found on the shores of the natron lakes of Egypt, was formed, as remarked by C. L. Berthollet, by double decomposition between the sodium chloride brought down by the rivers and the limestone on the shore. It would, therefore, contain unchanged calcium carbonate. It seems possible that, when this material was exposed in heaps to the weather, much of the soda would be washed out, leaving behind the insoluble limestone.

ex his vasa. Probably little ornamental vessels, as suggested by Michælis. It does not seem likely that useful vessels could be made either from the residual limestone, or from rock-salt, the substance imagined by Michælis.

nec non frequenter liquatum cum sulphure coquentes. These words were probably not intended to imply that the hard material thus made was used in making *vasa*, but simply that a stony substance could be thus prepared. As Beckmann, who considers the passage inexplicable, remarks, the substance made by heating soda and sulphur together would be analogous to the ' liver of sulphur ' made from potassium carbonate and sulphur —a hard mixture of sulphate, thiosulphate and polysulphides of potassium, which soon softens.

Dalechamps considers that there is a reference to glazing with soda and litharge. This seems most unlikely, as sulphur is never included as an ingredient of glazes.

In corporibus quoque quæ inveterari volunt. All manuscripts read *carbonibus* and *quas*. The difficulty of the passage has long been recognised. If *in carbonibus* is taken with the previous sentence, what were the objects to be preserved, and what is the grammatical construction? Jan seems to be on the right track when he considers that there is a reference to mummification, and he reads '*In carnibus quoque quas*'. When this is compared with the relevant passage in Herodotus (2, 87. τὰς δὲ σάρκας τὸ λίτρον κατατήκει. καὶ δὴ λείπεται τοῦ νεκροῦ τὸ δέρμα μοῦνον καὶ τὰ ὀστέα), it seems unlikely that Pliny could have written *carnibus*, for the 'flesh' was expressly stated not to have been preserved. I therefore read *corporibus*, and *quæ* for *quas*.

One must remark that Herodotus is not included in the list of authorities for this book, but this is not a vital objection to a conjecture based on the passage from his History, as his account had probably been reproduced by many earlier Roman writers.

112. *spumam nitri*. Probably, in general, a pure variety of *nitrum*. It may also have included ignited *nitrum*, which was partially causticised (see note on *nitri*, par. 106). It was the same as the *aphronitrum* of the following paragraph (cf. Isid. 16, 2, 8 and Mart. 14, 58, 1).

The curious metaphor of this paragraph can be, at least partially, understood. The *nitrariæ* must be 'pregnant', i.e. must contain some *nitrum* in solution, or they can give nothing. If the solution is not yet sufficiently concentrated for the *nitrum* to crystallise out in bulk, it may nevertheless be deposited in fine particles at the edges (*spuma nitri*), but, once the solution is saturated, the *nitrum* separates, no longer in fine particles, but in large crystals, carrying down with it some of the impurities present. The part played by the dew is obscure and may have existed only in the imagination of the *antiqui*.

fermento. See note on *nitri*, par. 106.

113. *aphronitrum*. See note on *spumam nitri*, par. 112.

mollibus. No doubt, in the sense of 'humid'. The two ideas are easily confused. In Ireland, a 'soft' day means a day which is wet and warm.

† *colligas* †. Many attempts have been made to emend this word. Hardouin conjectured *collicas* from κόλικας, 'round cakes', explaining it as meaning the round rocks from which the *aphronitrum* dripped. Detlefsen conjectured *corycias*, without, I think, sufficient grounds. Mayhoff suggested, without inserting it in the text, *collicias*, from H. N. 18, 179, and Columella 2, 8, 3. In both passages, the word means a 'channel for conveying water', and is no more suitable for the present case than Hardouin's conjecture. Sillig suggests σκώληκας, which is never used with reference to caves.

It seems to me that the original word is irretrievably lost, the copyist having written down *colligas* from *colligi* in the line above.

pæne purpureo. Sillig reads *plene* with Salmasius and R². *Pæne* seems more suitable. Cf. Isid. 16, 2, 8 (*pene purpureo*) and Diosc. 5, 131 (ἐμπόρφυρος).

ne liquescat. Cf. Diosc. 5, 130, where he speaks of the deliquescence of this substance. See note on *nitri*, par. 106.

inarescentia. Probably to remove all moisture which might be picked up by the *aphronitrum.*

114. *deprehenditur gustu ff.* Soda would dissolve much more rapidly than quicklime, which would, of course, burn the tongue (*pungit*).

odorem vehementem. Presumably the characteristic smell of lime which is being slaked.

tantum algæ. Bostock and Riley translate, ' though, as to plants, seaweed only ', and Ajasson and the Desaint edition take *tantum* in the same sense. Surely the words mean ' so much seaweed ', for Pliny is emphasising the fact that salt is more capable of supporting life than is *nitrum.* Salt and *nitrum* are mentioned together as plant foods in H. N. 19, 84.

115. *calciamenta... consumunt.* See note on *nitri*, par. 106.

Chalastræo. Cf. par. 107.

In pane. This suggests sodium bicarbonate. The Egyptian 'trona' contains bicarbonate as well as carbonate.

ad raphanos. Possibly, as Bostock and Riley suggest, to correct the acridity of the radishes.

opsonia. Anything eaten with bread; often used of fish.

olera viridiora. The use of soda for accentuating the green colour of cabbage is well-known. Cf. Apicius (3, 1), ' *omne olus smaragdinum fiet, si cum nitro coquatur* ', and Martial (13, 17, 1), ' *Ne tibi pallentes moveant fastidia caules, Nitrata viridis brassica fiat aqua* '.

NOTES. BOOK XXXIII.

1. *ipsæ opes.* i.e. gold and silver.

electrum. See on par. 80.

gemmas. Observe that the construction is a little complex. We should rather expect '*Alibi divitiis... alibi... gemmis... alibi... ferro*'. *Gemmas* and *ferrum* are attracted into the case of the accusatives *aurum... æs.*

parietum digitorumque pigmenta. Most edd. connect *digitorum* with *gemmas*, making the words mean 'gold for decorating walls and gems for fingers'. Thus, for example, Delafosse, who quotes H. N. 2, 158, to illustrate the phrase. Bergk even alters the order of the words and reads *alibi deliciis parietum digitorumque gemmas et pigmenta.* Mayhoff emends *digitorum* to *lignorum*, probably wrongly. If the text is corrupt, the fault is most likely to lie in *pigmenta*, which may have displaced a word meaning 'adornments' or something of the sort. It is possible that text and order are correct. Indian women still dye their finger-nails, and perhaps Roman exquisites dyed their fingers, though there seems to be no other reference to the practice.

ceu vero non hoc indignationes sacræ parentis exprimi possint. Mss. read *indignatione* and *possit*, but most attempts to translate this are paraphrases of the supposed sense. Bergk emends to *indignatio* but it seems unlikely that such a corruption would have occurred. An *s* might easily have fallen out before *sacræ* and *possint* have been subsequently altered to *possit* to provide a verb for *hoc*, taken as a nominative. Hardouin makes *exprimi=explicari*, a meaning which seems unlikely.

2. *in sede manium.* Strabo (3, p. 147) says miners in Spain dug 'as if they expected to bring up Pluto himself.'

parum benigna fertilique, quaqua calcatur. The other reading *secatur* in the sense of 'turned up by the plough' is also possible. The construction of *parum benigna fertilique* seems to be a loose ablative absolute.

3. *finis.* Here feminine, as also H. N. 30, 82; 33, 98 etc.

4. *chrysocolla.* See note on par. 86.

sanies auri. Cf. '*nihil aliud chrysocolla quam vena putris*' (par. 86).

minium. See Note on par. 111.

provocare, auxere et. Sillig, in his edition, omits *auxere* with B, taking the reading to mean that man has challenged nature and art to compete together in providing incentives to vice. All other Mss. however have *auxere* which makes the translation much easier. Cf. '*ea pictura naturam ipsam provocavit*,' H. N. 35, 94.

cælare iuvit. T has *Celebraverunt*, which may be translated 'They have represented many a vicious picture on their goblets', but I consider it a corruption of the reading given in the text.

libidines. Cf. Pliny's remark about Parrhasius (H. N. 35, 72), '*pinxit et minoribus tabellis libidines*,' and Juvenal (2, 95), '*Vitreo bibit ille Priapo*'.

5. *Murrina.* Mentioned by Pliny (H. N. 37, 204) as among the most precious products of the earth, *murrina* were highly prized among the ancients. In H. N. 37, 18-22, we have a long description of them. There we read of a consular who loved his myrrhine cup so much that he gnawed the edge, a fact which greatly increased its value! Many other references are found in Roman literature, e.g. Mart. 9, 59; 10, 80, and Prop. 3, 10, 22; 4, 5, 26.

It is doubtful whether the identity of this substance will ever be certainly known. The three main theories are (a) that it was porcelain, (b) that it was fluorspar, (c) that it was some variety of silica, such as onyx, opal, or agate, probably the latter.

The first theory received the support of Salmasius, Scaliger, Mariette and others, and is mainly based on Prop. 4, 5, 26, *murreaque in Parthis pocula cocta focis*'. However hard this line may be to explain, the description in H. N. 37, 18-22, makes it quite impossible to consider *murrina* as artificial articles. It is possible that there is a reference to heating agate to produce a change in colour. C. W. King suggests that this is Propertius' far-fetched way of referring to the same theory of origin as we find in Pliny 37, 21, '*umorem sub terra putant calore densari*'. The words '*murreus... onyx*' in Prop. 3, 10, 22 are also against the porcelain theory, which may be unhesitatingly rejected.

Corsi and Ajasson are responsible for the identification with fluorspar, and certainly the fragility, the varied colours and the translucence of fluorspar agree with Pliny's description. The variety called 'Blue John' is still used in Derbyshire for making ornamental vases. In the opinion of the writer, the greatest objection to this identification is the fact that no mention is made of the crystalline form of fluorspar. The least observant, on inspecting a collection of fluorspar, must be struck by the very perfect cubes in which the substance almost always crystallises. The form is so simple and so striking that it is hard to believe that Pliny, while describing accurately the form of rock crystal (H. N. 37, 26), would have omitted altogether to describe that of fluorspar.

On the whole, the opinion of C. W. King (Nat. Hist. of Gems) and Marquardt (Priv. 765-8) that agate is the substance in question is probably correct. Agate, with its undulating, many-coloured bands of chalcedony, cornelian, jasper, amethyst, and rock-crystal corresponds very well with Pliny's description. It occurs in geodes, which would provide naturally-shaped shallow cups, and, most important of all, the remains of many agate vessels have been found in Italy (v. C. W. King, op. cit.).

Crystallina. Frequently mentioned with *murrina.* See Pliny's description (H. N. 37, 23-29). Though regarded by the ancients as a variety of ice, there is no doubt that *crystallum* was rock crystal, i.e. colourless, crystalline quartz. The description of crystalline form (' *sexangulis lateribus* ') and smoothness (' *absolutus laterum lævor* ') in H. N. 37, 26, agrees perfectly with rock crystal, and in the phrase ' *neque in mucronibus eadem species est* ' we have probably a reference to the difference in form between right-handed and left-handed quartz.

Some authorities have considered that the word sometimes refers to glass, but this is most improbable. In the line of Martial (9, 59, 13) ' *Et turbata brevi... crystallina vitro* ', *vitro* refers to a flaw in the quartz. Propertius (4, 3, 52) evidently describes a small quartz crystal in ' *Crystallusque meas ornet aquosa manus* '. One of the most famous references in literature is to be found in Seneca, Dial. 5, 40, 2, where we get the story of Vedius Pollio and his *crystallina.*

argumentum. Cf. ' *amoris hoc argumentum, non malignitatis* ', Petr. 137, 8.

gloria. For *gloria* in this sense of ' ornament ', ' crown ', cf. ' *candidus, armenti gloria, taurus* ', Ov. A. A. 1, 290; ' *tardi pecoris gloria taurus* ', Tib. 4, 1, 209.

turba gemmarum. Refers, doubtless, to a cup encrusted with a large number of precious stones.

zmaragdis teximus calices. Possibly the goblet was entwined with interlacing bands of emeralds. Many editors seem to have considered *teximus* to be the perfect of *tego.* The present tense *potamus* makes this very improbable. In many cases where *texo* is used the sense of ' weaving ' is not very prominent, and in ' *Paullus basilicam texuit* ' (Cic. Att. 4, 16, 14) it seems to have disappeared. Cf. also H. N. 9, 117.

tenere Indiam iuvat. Tenere with the meaning ' to reach ' is not uncommon, and many examples of this meaning are given by Lewis and Short. The literal meaning ' to hold ', can hardly be entertained here, as the Romans never possessed India.

accessio. The Greek *πάρεργον.* When Pliny says that ' gold is now a mere appendage ', he means, I imagine, that it was only valuable when used as a mounting for more precious things.

6. *sacrum fame.* The reading of B, *sacrum famæ,* would be the easiest one to adopt, were it not for the words that follow. The reference in ' *ut celeberrimi auctores dixere* ' must surely be to Virgil's ' *quid non* *mortalia pectora cogis, Auri sacra fames*!' (Æn. 3, 57). That such was the opinion of the early scribes is shown clearly by the corruptions in h and e. Though Sillig says of *sacrum fame*, '*mihi... omni sensu destituta videantur*', I think that this reading, containing as it does a vague allusion to Virgil's well-known line, should be adopted.

celeberrimi has here the meaning of 'most illustrious', as frequently in later Latin.

optimis quibusque. *Quisque* with superlative, masc. and fem. plur., is rare.

convenit with a clause as subject is common in Pliny. In a note on par. 15, Sillig gives a list of the places where it occurs (2, 68; 5, 13; 7, 107; 9, 180; 12, 53; 17, 43, 68, 77, 249; 18, 136, 327; 22, 95; 25, 102; 33, 6, 15, 36, 91; 37, 78, 204.).

7. *captivisque rebus*. This is the reading of all Mss., but Sillig conjectured *res* for *rebus*, a conjecture which was introduced into the text by Mayhoff. The reason for the conjecture is found in Homer, Il. 7, 473ff, to which reference is obviously made in this passage :—

Ἄλλοι μὲν χαλκῷ, ἄλλοι δ’ἀίθωνι σιδήρῳ,
Ἄλλοι δὲ ῥινοῖς, ἄλλοι δ’αὐτῇσι βόεσσιν,
Ἄλλοι δ’ἀνδραπόδεσσι, τίθεντο δὲ δαῖτα θαλεῖαν.

It is not, however, necessary to read *captivis* as a noun to conform with *ἀνδραπόδεσσι*. Pliny has no words for *χαλκῷ* or *ἀυτῇσι βόεσσιν* and may have been speaking from memory. If *res* had been the original reading, it seems unlikely that it would have been displaced in all Mss. by the more difficult *rebus*. *Captivus* is often used with inanimate objects, e.g. *captiva pecunia* (Liv. 1, 53, 3); *captiva arma* (id. 9, 40, 15); *captiva vestis* (Virg. A. 2, 765), and many other instances.

quamquam et ipse, *mirator auri*, *æstimationes*. This is the reading of all Mss., but a later hand has introduced *qua* before *quamquam* and *pec*: before *æstimationes* as corrections in B. Bergk and Mayhoff have based conjectures on this, the latter editor reading '*quare*, *quamquam iam ipse mirator auri*, *pecore æstimationes*'. The corrections were made, in my opinion, by one who misunderstood Pliny's meaning, and it is neither necessary nor justifiable to make them the basis of an emendation.

arma aurea ff. Homer, Il, 6, 236.

8. *Prometheo*. See H. N. 37, 2.

Midæ anulum. The ring which had the property of conferring invisibility on its wearer is usually attributed to Gyges, e.g. Cic. De Off., 3, 38.

9. *manus sinistræ*. Most editors are agreed that there is here a play on the two meanings of *sinister*, which I have attempted to bring out in the translation.

Tarquiniis... quorum e Græcia fuit origo. Cf. Livy 1, 54, Pliny, H. N. 35, 16, and Aurel. Victor, De Vir. Ill., 6, 1.

10. *bulla aurea.* This story about Tarquinius Priscus and his son may also be found in Macrobius, Sat, 1, 6. This amulet was worn by boys until they assumed the *toga virilis*, and by girls probably until their marriage. Cic., Verr. 2, 1, 58, 152, uses the same word *insigne* of the *bulla*, '*bulla erat indicium et insigne fortunæ*'. Exactly what was the *lorum*, which poor children wore instead of the golden *bulla*, is not certain. Hardouin considered it as the thong by which the *bulla* would have been suspended, knotted at one point to represent the *bulla*. Juvenal 5, 165 supports this view, '*nodus tantum et signum de paupere loro*'.

in prætextæ annis. The *prætexta* or *toga prætexta* was a garment, bordered with purple, worn in Rome by free-born boys until they assumed the *toga virilis*, which was usually done about the age of seventeen.

equo meruissent. Cf. Cic., Phil. 1, 8, 20.

a digitis. δακτύλιος from δάκτυλος.

ungulum. An Oscan word. Festus says '*ungulus Oscorum lingua anulus*' (p. 375, Müll.). Lewis and Short derive from the same root as ἀγκύλος, *ancus*, *aduncus*, *angulus*.

symbolum. i.e. signet ring. Plautus, Pseud., 1, 1, 53-4, '*Ex causa miles hic reliquit symbolum, Expressam in cera ex annulo suam imaginem*'.

11. *æque... et. Æque... ac* is, of course, more usual in this sense. But compare Pliny H. N. 20, 234, '*cœliacos æque et dysintericos*', also some Mss. of Hor., Epp. 1, 1, 92.

servi. Slaves at Rome wore iron rings. Cf. Statius, Sylv. 3, 3, 144, '*Mutavitque genus, lævæque ignobile ferrum Exuit.*'

fortasse. The word here seems meaningless. Mayhoff notes that it is only once before used by Pliny (H. N. 7, 9), and conjectures *præ se*, quoting H. N. 8, 2, where it is used of an elephant carrying a calf. It is more likely that *fortasse* crept in from a marginal gloss.

coronam. Cf. Tertullian (de Cor. 13), '*superferuntur etiam illis Hetruscæ*', and Juv. 10, 39, where jesting reference is made to the '*magna corona*' of the Prætor.

12. *triumphavit de Iugurtha C. Marius.* The date of this triumph was Jan. 1, 104 B. C. Hardouin remarks that it was strange that Marius did not wear a gold ring earlier, because, when Scipio was besieging Carthage, the bodies of Roman tribunes, when selected for burial by Hasdrubal, were distinguished by rings of gold. The explanation is probably that given in the Desaint Edition, that Marius was not of equestrian rank, and so had no right to wear a ring.

quo argumento. Women took no part in public life. Their sphere was '*intra domos*', and an iron ring was, therefore, the appropriate gift.

sine gemma. There are several Greek adjectives to describe a simple hoop-ring, e.g. *ἄπειρος* Arist., Phys., 3, 6, 10; *ἀπείρων* Ar., Fr., 247; *ἄλιθος* Poll., 7, 179.

codicillos missitatos. Cf. Homer Il. 6. 169, *γράψας ἐν πίνακι πτυκτῷ θυμοφθόρα πολλά*, and Pliny H. N. 13, 17, '*Bellerophonti codicillos datos, non epistolas.*'

ea colligata nodi, non anuli nota. Cf. Homer Od. 8, 443, 447. The expression is a trifle unnatural, but not impossible. *eas colligatas* may be right.

13. *contra provocationem.* Cf. Homer, Il. 7. 175-176, also Soph. Ajax, 1285-6.

The Homeric heroes drew lots by casting stones or potsherds into a helmet and shaking until one leaped out. These lots were marked in some way, but not by stamping them with a signet ring. This is probably what is meant in the present passage. Or possibly Pliny means that rings themselves were not shaken up in the helmet to decide who should have the honour of accepting a challenge.

fabricæ deum. Cf. Homer., Il., 18. 400, and Cicero, N. D. 3, 22, 55, '*Vulcanus, qui Lemni fabricæ traditur præfuisse*'. Dalechamps and Brotier read *fabricam deum* with no support among extant Mss. Bostock and Riley appear to take '*fabricæ deum*' as meaning 'at the forge of the gods'.

latentibus. i.e. beneath the toga.

Quodsi impedimentum ff. This passage presents some difficulty of interpretation, but I think that the translation which I have given is reasonable. Pliny seems to me to say, 'Whatever explanation we give of the custom of wearing rings on the left hand does not affect the view that rings were a late invention.' Sillig reads '*serior is usus argumentum est, et maius in læva fuisset, qua scutum capitur*', and says that '*serior is usus*' refers to Macrob. Saturn. B. 7, c. 13, where Ateius Capito says '*Hinc factum est ut usus anulorum exemptus dextræ, quæ multum negotium gerit, in lævam relegaretur, quæ otiosior est : ne crebro motu et officio manus dextræ pretiosi lapides frangerentur.*' This belief that rings were originally worn on the right hand is ignored by Sillig, whose note is too long and complicated for quotation. I do not think that the text can have the meaning which he suggests. Mayhoff abandons '*serior is*' in favour of '*serioris*'.

virorum crinibus aurum implexum. Homer, Iliad 17, 52.

sed ego nescio an. All Mss. read *ideo*, which seems to me to give very poor sense. The change suggested is easy, and gives a natural sequence of thought.

14. In this section Pliny points out that Rome was not always '*aurea Roma*'. The account of the transactions after the capture of Rome by the Gauls in 390 B. C. is taken from Livy, Bk. V, 41 ff.

Nec ignoro... perisse. An alternative reading adopted in some editions is ‘ *Nec ignoro M. Crassum duo millia pondo auri rapuisse suo et Pompeii secundo consulatu* ’. It is not likely that in 55 B. C., the date of the second consulship of Pompey and Crassus, the latter, who was already fabulously rich, would have committed the theft. The story was no doubt circulated about him, and then introduced into some of the Mss.

15. *Gallos autem...* This phrase is evidently parenthetical, so I have bracketed it in my translation. Torquatus won his *torques* in 360 B. C., at the battle of the Anio. (Livy 7, 10).

augurio. The exact meaning of this is unknown.

fracta in ore anuli gemma. Poison was no doubt concealed beneath the stone. Such a custom was not uncommon in antiquity, and Hannibal (Aurel. Vict. de Viris Illust. C. 42) and Demosthenes (H. N. 33, 25) are among those who sought death in this way.

indicium. Evidence as to the perpetrator of the theft.

16. *vel maxime.* Read in accordance with a conjecture of Dr. L. C. Purser. *Ut maxime* in this sense does not seem to occur. Cf. H. N. 33, 25 where Bergk reads *vel* for *ut*.

CCCLXIIII. Livy gives the date as 365 A. U. C.

in triumpho transtulit. Cf. Livy 37, 58, 4, and Livy 39, 42, 4.

C. Marius filius. The son of the great C. Marius, he was consul with Carbo in 82 B. C. at the age of 25. He was besieged by Sulla in Præneste and committed suicide when the city was captured.

17. The story of Cn. Flavius is given by many authors, including Cicero (Pro Murena, 25), Livy (9, 46), Val. Max. (2, 5) and Macrobius (Sat. 1, 15). Valerius Maximus says ‘ *Ius civile... Cn. Flavius... vulgavit, et fastos pæne toto foro exposuit.* ’

deprehenditur. Cf. Quint. 9, 3, 40. ‘ *Apud Ciceronem mira figurarum mixtura deprehenditur.* ’

Cn. Flavium Anni filium. Livy (9, 46) has *Cn. filius*. The best ms. of Cic. (Att. 6, 1), and Gellius (6, 9) read *Anci*. Sillig prefers *Anni* to *Annii*, on the grounds that the latter is a gentile name. For *Annus* as a prænomen, see Thesaurus Linguæ Latinæ.

publicatis diebus fastis. The *dies fasti* were the days on which the prætors were permitted to use the words, ‘ *do, dico addico* ’. (*Fasti* —same root as *for*, i.e. ‘ speaking days ’.) Flavius, therefore, disclosed the days on which legal action might be taken. For this rare meaning of *publicare*, cf. Just. 2, 15, 17, ‘ *Xerxes, cum proditionis dolum publicatum videret, bellum instituit.* ’

Appi Cæci. Appius Claudius Cæcus was censor in 312 B. C. He conferred the franchise on freedmen, thus enfranchising many tradesmen and artisans, and admitted their sons to the senate. In 304 B. C. Cn. Flavius was elected curule ædile, and the publication of the calendar took place. Appius Claudius constructed the Appian Road and the great aqueduct.

hostis. Perhaps in the Etruscan War of 311-308 B. C. This can hardly refer to fighting against Rome for Præneste itself. According to the Corpus of Latin Inscriptions (XIV, p. 288, note 8), Præneste had been at peace with Rome since 338 B. C. (34 years earlier).

18. *anulos abiectos*. Cf. Livy's account (note on par. 17). Hardouin quotes Livy 9, 7, '*anulos aureos positos*' after the battle of the Caudine Forks, and Suet. Oct. 100 that after the death of Augustus '*alii exsequiarum die ponendos aureos anulos, ferreosque sumendos censuerunt*'. A similar occurrence is recorded in Livy, 43, 16.

phalera posita. The usual Latin form is *phaleræ* (fem. plur.), but almost all mss. here read *phalera* (B. has *phaleras posita*). It seems likely that the neuter form, corresponding to the Greek τὰ φάλαρα, is possible in Latin. Varro (Men. Sat. 97) has '*ubi illa phalara gemmea atque ephippea*' where the form must be a neuter plural. *Phalera* were originally ornaments worn on the headgear of horses (Suidas; Hesychius). Cf. Livy 22, 52, 4, '*Argenti, quod plurimum in phaleris equorum erat*', Juv. 11, 103, '*ut phaleris gauderet equus*'. In Latin literature there are many references to *phalera* as a military ornament (Juv. 16, 60, '*Læti phaleris omnes et torquibus*') or as a mark of distinction for equites (Livy, 39, 31, '*equites donati phaleris*').

19. *ordines*. Senate and equites.

multatitia. Really an adjective, sc. *pecunia*.

Græcostasi. A building in Rome, near the Curia and Comitium, where Greek and later other foreign ambassadors took up their abode. Cf. Pliny, H. N. 7, 212, Cic. Quint. 2, 1, 3, and Varro, de Ling. Lat. 5, 155.

CCIII. Many Mss. read *CCCIIII* which would put back the dedication of the Capitoline temple to the reign of Tarquin the Elder. The Fasti gave the honour of the dedication to M. Horatius Pulvillus.

20. *Id a*. The Mss. read *ita* which does not seem the right word. The omission of *anno* is also unusual. The emendation '*Id a.*' (sc. *anno*) by C. W. F. Müller seems to remove both difficulties and has been adopted by Mayhoff.

Trimodia. St. Augustine, De Civ. Dei, 3, 19, gives the same figure. Florus 2, 16 says two *modia*, and Livy 23, 12, three and a half. The *modium* or *modius* was about a peck.

Q. Servilius Cæpio and M. Livius Drusus had each married the other's sister. The murder in 91 B.C. of Drusus, tribune for that year, and champion of the Italians, hastened the outbreak of the Social War.

His opponent, Cæpio, legate of the consul Rutilius, fell in an ambush in 90 B. C.

auctio. A sale by *increase* of bids.

21. *ferreo*. The wearing of iron rings in early times was not a sign of humility, but was due to the fact that iron was at first a precious metal. Iron ores are abundant, but the extraction of the element demands a high degree of skill. Iron rings have been found with gold rings in the tombs at Mycenæ.

Calpurnium. Probably M. Calpurnius Flamma, who is mentioned in H. N. 22, 11, as having received the *graminea corona*, or 'grass crown', which was only awarded by the vote of the soldiers to one who had saved the army in desperate straits. His exploit is mentioned in Livy 22, 60.

L. Fenestella. Historian in the reigns of Augustus and Tiberius. Died A.D. 20.

Scaurus de vita scripsit. Cf. Cic., Brut., 29, '*Tres ad L. Fufidium libri, scripti de vita ipsius acta, sane utiles quos nemo legit*'.

The Quintii. A patrician family, branches of which were the Cincinnati, the Capitolini, the Crispini, and the Flaminii.

fuerit... habeat. Subjunctive by attraction into the mood of *consenuerint*.

22. *Non signat*. All editors have remarked that Pliny is here clearly mistaken. There are many references to the use of seal-rings in Egypt and the East. The Delphin edition quotes Genesis 41, 42, 'And Pharaoh took off his ring from his hand, and put it upon Joseph's hand'. Josephus, Antiq. Jud. 2, 3, calls this σφραγῖδα. The note of the Lemaire edition on this passage is short and to the point — '*Non credo*'.

digitos onerando. Pliny disapproved of this vulgar ostentation. In Bk. 2, 158 he says '*Quot manus atteruntur, ut unus niteat articulus*'. Cf. also Martial 5, 11. '*Sardonichas, smaragdos, adamantas, iaspides uno portat in articulo Stella, Severe, meus.*'

gemmarum volumine. I.e. Bk. 37.

alias. The adverb.

violari. Cf. H. N. 37, 1, '*violari signis.*'

23. *neque ab ea parte qua digito occultantur auro clusit*. The stones were set so that, when the ring was not on the finger, light could shine through and set off the beauty of the stone. Diamonds are usually thus set at the present day.

Nec non et servitia ff. A passage of considerable difficulty. Early editors took *alia* as meaning *alia servitia* and considered that two kinds of rings were described. Hardouin's note reads '*Nec non etiam servi ferreum anuli capitulum cingunt auro, sic ut ferrum vix emineat, addito alii circulo ex auro mero ei capitulo ferreo decus addunt*'. As Sillig remarks, it is hard to see any difference between the rings thus described. *Ferrum auro cingunt* evidently describes the Samothracian ring, the '*Samothracia* *ferrea*' mentioned by Lucretius (6, 1044) as drawn by a magnet, and described in Isidor. Hispal. Orig. 19, 32, 5, '*Samothracius anulus aureus quidem, sed capitulo ferreo, a loco ita vocatus*'. For *decorant* Lipsius conjectured *decolorant*, making the second ring like that described by Petron. Sat. 32, '*aureum, sed plane ferreis veluti stellis ferruminatum.*' As Sillig points out, '*mero auro decolorant*' is rather ridiculous, and in any case, '*ferrum auro decolorari*' and '*aurum ferro decolorari*' are two very different things. In my opinion, the explanation of Sillig is correct, that *alia* is accusative case, and that the phrase is a parenthesis showing that though slaves did not dare to transgress the law so far as to wear a ring of pure gold, they adorned other parts of the body and their possessions with the precious metal.

per sese. Possibly with *mero* — 'perfectly pure gold'.

24. *et minimo dare.* In Greek τὸ ἀκαρές was the special name given to a ring placed on the little finger.

privatim. Cf. H. N. 34, 151, where the word obviously means 'specifically'.

signantem. Hardouin understands the noun to be *digitum*, Sillig *anulum*, the view taken by Bostock and Riley. The latter view is almost certainly correct.

25. *iniuria.* The order is *indigna iniuria usus.*

alii pondera. We are reminded of Crispinus, '*verna Canopi*', in Juv. 1, 28f. '*Ventilet æstivum digitis sudantibus aurum, Nec sufferre queat maioris pondera gemmæ*'.

casum. It is clear from Martial 14, 123, 1, '*Sæpe gravis digitis elabitur anulus unctis*', that the literal meaning of *casus* is the correct one. Dalechamps explains, 'Lest the ring fall, being too heavy, and the stone be lost'.

Demosthenes. See note on par. 15.

26. *cibi ac potus.* Cf. Plaut. Cas. 1, 2, '*Obsignate cellas: referte anulum ad me*'. In spite of Pliny's rhetorical *nunc*, the custom was evidently at least three centuries old.

turba externa. Athenæus mentions a household which included 20,000 slaves.

Marcipores. I.e. *Marci pueri.* Cf. Quint. 1, 4. The custom is also mentioned by Priscian, Probus and Festus.

gentiles. This is not the strict meaning of the word. Cicero says '*gentiles sunt, qui inter se eodem nomine sunt,..., quorum maiorum nemo servitutem servivit*'. (Top. 6, 29). The word is here practically equivalent to 'family-servant'.

nomenclator. The word was originally used of a slave who attended his master when canvassing. The present use is a later one.

27. *gravatis somno aut morientibus.* The ring of Tiberius was stolen from the dying emperor by Caligula. When Tiberius awoke and demanded the ring he was smothered with a pillow (Suetonius, Tib. 73). Tacitus and Dio add that he was smothered by the orders of Macro.

Polycraten. Cf. Val. Max. 6, 9, ext. 5; Her. 3, etc. There is reference to the familiar story of Polycrates, who threw away a favourite ring to inflict loss on himself, because his luck was too good to last. '*Ille anulus*' because the story is so well-known.

interfecto. He was crucified by Oroetes, the Persian satrap of Sardis.

28. *anulo exsiliente.* Hardouin compares Genesis 38, 18. « And he said, what pledge shall I give thee? And she said, Thy signet... » The ring was a *pignus*, not an *arrabo*, which was part of the purchase money (see Robey's Roman Private Law, p. 139.).

29. *tunica.* Sc. *laticlavia.*

tertium ordinem mediumque. This reading, given by the best Mss., gives quite satisfactory sense. Bergk conjectured '*tertium ordinem medium*' which is easier to translate but not necessarily more correct for that reason. The conjecture of the Desaint edition, '*medio ordini tertium, plebem patribus*' does not seem to mean anything.

pecuniæ indices. I.e. *anuli.* '*Indices*' seems much superior to the other reading, '*iudices*'. Sillig quotes Lipsius who says '... *omnes, quibus anuli aurei, pecuniæ indices ac testes*'.

30. *Divo Augusto decurias ordinante.* Cf. Suet. August. 32. Pliny's account seems a trifle confused. There were not four decuries '*primo*', but three, the fourth being added by Augustus. For information about the decuries, see Shuckburgh's note on Suet. Aug. 32.

subsistebat in. Lewis and Short, who translate « subsists only in », by using the present tense seem to miss the meaning of the passage.

novis civibus. Apparently those whose fathers had not been citizens. Hardouin says '*Peregrini, qui ius civitatis nuper essent adepti*'.

31. *tribunorum æris.* Most editors seem to consider that these are the same as the *tribuni ærarii* from whom one-third of the *judices* was taken in accordance with the Lex Aurelia Cotta of B.C. 70.

selectorum iudicum. I.e. the *album* selected by the Prætor Urbanus for service in the *Quæstiones Perpetuæ.* All mss. read '*selectorum et iudicum*'. *Et* is omitted in this edition in accordance with a conjecture by Dr. L. C. Purser. It seems impossible to coordinate with *tribunorum æris* and *selectorum* the word *iudicum* which includes both these terms. For *selecti iudices* cf. Hor. Sat. 1, 4, 123, '*iudicibus selectis*', and Cic. Cluent. 43, 121, '*iudices selectos*'.

etiamnum. For this meaning, cf. H. N. 6, 211; 16, 47; 32, 49.

et divisus hic quoque ordo. There seems to be a redundancy here. Bergk considers the sentence a marginal note made by Pliny himself, and afterwards inserted in the text.

32. *aucupatus.* Cf. *studium populi ac favorem aucupatur* (*tribunicia potestas*)' (Flor. 3, 13, 1); '*famam sibi aucupantur*' (H. N. Præf. 30).

popinarum. Suetonius (Tib. 34) says that Tiberius gave the ædiles orders to suppress '*popinas ganeasque*'.

defendi. A middle use.

qui, ingenuus ipse patre, avo. Sillig remarks that *ingenuus patre* is as correct as *generosus domo* (Virg. Æn. 10, 141). The reading '*cui ingenuo* (*ipsi*) *patri avoque*', given by the Mss. other than B and read by the early editors, gives a most improbable meaning. It is unlikely that, to be a knight, one's grandfather should have had to possess this large income.

lege Iulia theatrali. The reference seems to be to a law of Augustus, passed in 23 A.D. (Mommsen). The fourteen rows were originally fixed by the Lex Roscia Theatralis (B. C. 67).

33. *decuriam quintam adiecit.* Suetonius (Cal. 16) gives as reason '*ut levior labor iudicantibus foret, ad quattuor priores quintam decuriam addidit*'.

quadringentos... reos postularet. Presumably for wearing the ring without due authority.

34. *Iudicum... appellatione.* This does not, of course, imply that the name *iudices* now came into use for the first time. The *iudices* had previously been taken from the senatorial class.

circa publicanos substitit. The power of the equites had been reduced by the Leges Liviæ, B.C. 91, and their privileges wiped out by Sulla. The *publicani*, who had the equestrian census, were now the most prominent members of the class.

qua de causa et nunc post populum scribitur. All authorities, from Hardouin to Mommsen, are agreed that the order given by Pliny is never found in inscriptions, which have the order '*Senat. et eq. ordin. P. Q. R.*' The Desaint edition remarks that these inscriptions were mostly provincial, and that Pliny's order was that in use in Rome, but gives no proof of the latter assertion.

35. *qui id ab equitatu trahebant.* This, the reading of B, gives much better sense than that of the early editors, '*qui ad equitatum trahebantur*'. Besides T, V retains a trace of the *id*, reading *quid*.

celeres. Livy (1, 15, 8) mentions them as a body-guard of 300 chosen by Romulus to attend him in peace and war. The word probably meant simply 'the swift', although it has been variously derived from κέλης, a war-horse, and from Celer, the slayer of Remus (the latter the version of Festus). The original *celeres* can hardly have been *equites*, as the number of the latter was not raised to 300 until the days of Tullus Hostilius.

flexuntes. The spelling of the word is doubtful, and the derivation equally uncertain. Servius, in a note on Verg. Æn. 9, 606, (‘*Flectere ludus equos*’) says ‘*Flectere autem verbo antiquo usus est, nam equites apud veteres Flexutes vocabantur, sicut ait Varro*’. The Desaint edition conjectures ‘*floxumines*’ i.e. *minime floxi* (= *minime tardi*), and compares the Castilian *floxo* (same root as *flasque*).

trossuli. According to Festus, they captured Trossulum. The Desain edition makes the very plausible suggestion that the word is connected with the Etruscan *tross* — a horse (cf. French *rosse*, and English ‘horse’). Pretor suggests *troiugenæ* (Juv. 1, 100) as derivation.

36. *Junius*. One of the Roman authorities used by Pliny in compiling Bk. 33. He wrote the *De Potestatibus*, praised by Ulpian. See Teuffel and Schwabe, 138, 2.

multos pudet eo nomine appellari. According to Salmasius, because of its likeness to τρυσσός, an ‘effeminate’, or worse. For *trossuli* in the uncomplimentary sense, cf. Pers. Sat. 1, 82 (with the scholion), and Seneca, Epist. 76, 2 and 87, 9.

37. *cives non nisi argenteis*. Dionysius of Halicarnassus says that Siccius Dentatus received a *gold* torc. He may, of course, be mistaken. For the whole custom of giving bracelets and crowns to soldiers, cf. Livy 10, 44, ‘*manipulum hastatorum armillis aureisque coronis donavit*’.

38. *A. Postumius.. coronam... dedit l.* The battle of Lake Regillus took place in 431 B. C. Most editions read simply ‘*dedit*’, but the words ‘*sed huic quinque librarum*’ demand a weight for the crown given by Postumius. This fact led Bergk to add ‘*librarum III*’ and Mayhoff *II l.*’, but the first reading of B. seems to afford a good meaning without any emendation.

L. Lentulus. Consul in 275 B.C. Curiously enough, Cornelius Merenda was consul in the following year.

Piso Frugi... prælegavit. I.e., he bequeathed the crown to be paid for before the inheritance was divided. Urlichs conjectured *trium Piso Frugi* (a conjecture adopted by Mayhoff), on the strength of a passage in Val. Max. (4. 3. 10), ‘*filium suum titulo trium librarum aureæ coronæ decoravit*’.

39. *auratis cornibus*. There are many references to this gilding of horns, e.g. Tibullus 4.1.15.

haec luxuria. For the contempt which the Parthians felt for the effeminacy of the soldiers of Crassus, and the licentious books which they brought with them into the field, see Plutarch, Crassus, 22.

fibulas tribunicias. These *fibulæ* were clasps by which the *sagum* was secured on the shoulder. The passage suggests that there was a special *fibula tribunicia*, but there seems to be no further evidence on the subject. Cf. Livy 39, 31, 18, ‘*Quintius... equites catellis ac fibulis donavit*,’ and 27, 19, 12, where Livy tells how Scipio gave an *aurea fibula* to a Numidian boy whom he was releasing from captivity.

mulierum pedibus aurum gestatum. No doubt *periscelides*, such as are mentioned in Horace, Ep. 1, 17, 56. Pliny (H. N. 33, 151) mentions *compedes* of silver.

sceleris arguimus illum. See par. 8.

40. *armillis.* The sentence reads as if *armillis* were parts of the body, like *digitis*, *collo*, etc., but this necessitates a derivation from *armillus*, a non-existent diminutive of *armus*. Many editors accept this, but I consider it quite impossible. *Armus* always means the shoulder of an animal, and Pliny himself makes the distinction quite clear (H. N. 11, 243), '*terrestrium solus homo bipes*; *uni iugulum*, *umeri*, *ceteris armi*'. The true explanation, in the opinion of the editor, is that the words as originally written were '*lacertis digitisque*' or '*bracchiis digitisque*', and that over the first word a commentator wrote *armillas*, which eventually displaced the original noun. A passage which shows extraordinary similarity to the one before us is to be found in H. N. 9, 117, where *monilibus* seems equally out of place, and may have been a gloss on *collo* which precedes it.

spiris, *discurrant.* The Desaint edition suggests that the comma should be removed and that *spiris* should go with the following phrase. The general form of the sentence seems against this ingenious alteration. For *spira* in the sense of 'lock of hair', cf. H. N. 9, 117.

feminarum equestrem ordinem. Roman matrons wore the *stola* which reached to the ground. Women of the lower classes wore the *toga* which revealed the feet. Pliny implies that women who showed their feet and ornamented them with gold came in between these two classes, as the equites came between the senators and the plebeians.

41. *Harpocraten.* Harpocrates appears to have been a divinity of silence. This is clear from an obscene lyric of Catullus (74, 4), '*patruum reddidit Harpocratem*', i.e. rendered him silent. Ovid (Met. 9, 692), in a list of Egyptian divinities, probably refers to Harpocrates in the words, '*quique premit vocem*, *digitoque silentia suadet.*' Ajasson suggests that Harpocrates on a signet-ring was a symbol of the secrecy to be observed in written communications.

insolens. Perhaps simply 'unusual', but the sense 'arrogant', common in classical Latin, is probably also implied.

admissionem liberti eius dedissent. In the reign of Claudius the Imperial Household (and to a large extent the administration of the state), was controlled by freedmen, of whom the most famous were Pallas, Narcissus, and Callistus. The reading in the text is that of practically all the mss., with the exception of B. Sillig reads '*admissionis liberæ ius dedissent*', with the note « sc. *admissionales* ». This word does not seem very easy to understand, and the version in the text seems preferable. Mommsen (Staatsrecht, Ed. 2., 2, 787, 1) prefers '*admissiones liberæ ius dedissent*'.

magna criminum occasione. Informations, presumably, being laid against those who wore the Emperor's likeness without having received the *admissio.*

42. *Proximum scelus.* Cf. par. 8, '*Pessimum vitæ scelus fecit qui primus induit digitis*'.

ne argento quidem signato ante Pyrrhum regem devictum. Pyrrhus was finally defeated at Beneventum in 275 B. C. The date of the first coining of silver is given below (par. 44) as 269-8 B. C., five years before the first Punic War, which began in 264 B. C.

libella. Diminutive of *libra* (1 as). The form may have some reference to the diminution in the weight of the as (par. 44, ff).

assis. Late form, occurring also in scholion on Persius 2, 59. The Thesaurus Linguæ Latinæ doubts its correctness here.

æris gravis. The term no doubt originated in the days when the as was measured by weight.

43. *stipis.* According to Varro (de L. L. 4), '*æs quoque stipem dicebant*,' and gave as reason that those who had much money packed it away (*stipare*) in a *cella*, not in an *arca*, that it might occupy less room.

dispensatores. Stewards or cashiers.

libripendes. In addition to the more general meaning of 'paymaster', *libripens* signifies the official who held the traditional balance at sales '*quæ mancipii sunt*'. Bostock and Riley wrongly regard these sales as of slaves only. It is clear from Gai. Inst. 1, 119ff. that many things were sold by *mancipium.* The list includes slaves and free people, oxen, horses, mules, asses and real estate, both urban and rural. See Sandars (Institutes of Justinian, Introd. 46-7 and 56-7).

Timæus. Mentioned by Pliny in his list of authorities for this book.

nota pecudum. Bostock and Riley translate *pecus* by 'sheep', but Varro makes it clear that a more general term must be used. Varro ap. Nonium p. 189, '*Aut bovem, aut ovem, aut vervecem, habet signum.*'

prima classis. Gellius (Noctes Att. 7, 13) gives the qualification for the first class as 125,000 asses, but does not say if this refers to the Servian classification. Livy (1, 43), on the other hand, gives the qualification fixed by Servius as 100,000 asses.

44. *Q. Ogulnio.* The name of Ogulnius is omitted in most Mss. but is present in B. In V and *a* it is represented only by the letter *o.*

imminutum est bello Punico primo. According to Festus (17. s.v. *sextantarii*) the reduction of the as was '*propter bellum Punicum* secundum, *quod cum Hannibale gestum est.*' The following section mentions a *second* reduction during the war with Hannibal; Festus probably confused this with the reduction to the *sextans*, and Pliny is no doubt right.

45. *rostrum navis.* Cf. Ovid (Fasti 1, 239) '*at bona posteritas puppim formavit in ære Hospitis adventum testificata Dei*' (i.e. *Saturni*). Macrobius

(Saturn. 1, 7) relates that boys, when tossing coins, used to cry '*aut capita aut navim*?' where we say 'head or tail?'

denarium sedecim assibus permutari. The same scale of values is given by Vitruvius (3, 1).

46. *in militari tamen stipendio ff*. An additional encouragement to soldiers. These would doubtless meet with difficulties of exchange in parts of the empire remote from Rome. Sandys remarks that we have here clear evidence that the Roman coinage was on a token basis. The soldier's yearly stipend at this time was 1200 asses, for which he continued to receive 120 denarii, not 75 only (v. Grueber, Coins of the Roman Republic. Introd. p. xxix).

lege Papiria. 89 B. C.

Livius Drusus. Tribune of the plebs in 91 B. C.

Victoriatus. Used as a measure of weight in indicating the proportions of drugs, H. N. 20, 264; 23, 113; 24, 6, 16, 30; 26, 34, 53. Before it was officially adopted at Rome as a coin, it was no doubt purchased by weight (*mercis loco*) by merchants with foreign trade, and used by them to buy commodities in the Mediterranean countries.

lege Clodia. Generally held to have been passed in 104 B. C.

47. *LI*. Superior to the variant *LXII*. Silver was first coined in 269-8 B.C. (v. par. 44). Gold coins seem to have been struck at the same time as the reduction of the value of the *as* when Fabius Maximus was dictator (v. par. 45), i.e. 217 B. C.

ita ut scripulum valeret sestertiis vicenis, *quod effectum in librali ratione sestertii qui tunc erat CCCC*. This paragraph is admittedly one of the most difficult in the whole book. Sillig reads *quod effecit in libras ratione serterti qui tunc erat sestertios DCCCC*.

It is usually assumed that the *libra* in question is the pound of gold. As there are 288 scruples to the pound, there should therefore be 5760 sestertii to the pound of gold, whereas all Mss. give either 400 or 900. Parisot in Ajasson's edition argues as follows, adopting the latter figure: — Taking the sextantal *as* as standard, the value was reduced to 1/2 in the time of Fabius Maximus, then to 5/8 of that when the change from 10 to 16 asses to the denarius was made, finally to 1/2 again, so that the semiuncial *as* was only 5/32 of the sextantal *as*. But 900 is 5/32 of 5760; therefore 900 sesterces (at the time of the sextantal *as*) were equal to the libra of Pliny's day.

This ingenious solution is quite incorrect, as the value of the sesterce was not reduced at the same rate as that of the *as*. When the *as* became 1/16, not 1/10, of the denarius, the value of the denarius and the sesterce presumably did not change.

Bocking (Inst. I. p. 343) thinks that Pliny reduces 5760 sesterces (=14400 *asses* at 1/16 of a *denarius*) to *asses* at 1/10 of a *denarius*. This gives 9000 *asses* =900 *denarii*. Mommsen rightly condemns this calculation as too complicated to be introduced by Pliny without a word of explanation. In any case, the best Mss. do not mention *denarii* at all.

Mommsen himself takes the heroic measure of emending CCCC to $\overline{\text{V}}$DCCLX. This change is so extraordinary that to adopt it is a confession of complete failure.

The method suggested by the editor is to adopt the reading of B, changing only *effecit* into *effectum*. The *libra* is now the pound of silver and the passage means that the smallest gold coin now made, which weighed a scruple, was to be the equivalent of 20 sesterces at the current rate of 400 sesterces to the pound (of silver).

The only weak point in this interpretation is the fact that there were officially 84 *denarii* (336 sesterces) to the pound of silver (H. N. 33, 132). Grueber (Coins of the Roman Republic 1, 44) gives the weights of many unworn *denarii* of this period, from which it is clear that they varied greatly in weight, and that the average weight of a denarius was about 1/90 of a lb. of silver, making 360 sesterces to the lb. This does not differ greatly from 400, and Pliny may have made an approximation. The editor claims no perfection for this explanation, but considers it less improbable than any yet put forward.

The gold coins introduced at this time weighed 3,2 and 1 scruples, and were stamped as equivalent to 60, 40 and 20 sesterces.

The gold *denarii* mentioned later in the section (40 to the lb.) were issued by Julius Cæsar in 49 B. C., and were entirely different.

For further information, v. Grueber (*Op. cit.*).

48. *parricidio.* For *parricidium* used of murdering one who is not a relation, cf. Cicero (Verr. 2, 5, 66, 170.), '*facinus est vinciri civem Romanum*; *scelus verberari*; *prope parricidium necari.*' Even here it is qualified by *prope*. *Parricida* is often used of assassins in general.

aliquis. Abl. plural.

Aquilio duci capto. B. C. 88.

49. *nomina... nova Græco sermone.* e.g. *Chrysendeta*, which are probably referred to here. It seems to have been fashionable to serve mullets on these dishes. Mart. 2, 43, '*Immodici tibi flava tegunt chrysendeta mulli*', and Mart. 14, 97, '*Grandia ne viola parvo chrysendeta mullo*'.

insperso. Evidently the word refers to work resting on the silver, as opposed to *incluso* which refers to gold inserted into excisions in the other metal.

pluris veneunt inaurata quam aurea. Cf. H. N. 33, 5. '*aurum iam accessio est.*'

Spartacum. Cf. Appian (Civil. 1, 117), '*Aurum porro et argentum negociatores inferre prohibuit, aut illud possidere. Æs solum.*'

50. *Messalla.* M. Valerius Messalla Corvinus. Born B. C. 69 (see Meyer fragmm. oratt. Rom. pp. 208-10).

Hagnonem... aureis clavis suffigere crepidas. The soles were evidently tacked on with gold nails. The story occurs also in Plutarch, Alex. p. 688 C, ed. Xylander, where the nails are said to be of silver.

vilitatem. Sillig adopts *utilitatem*, the reading of B. It seems clearly wrong to say that Antony first used gold for utilitarian purposes. The gold nails in Hagnon's shoes were surely *utiles.*

51. *octingenta milia,* $\overline{XVI}$ *pondo annua.* Sillig keeps the reading of B, *octingena milia pondo annua*, though it is clear from passages in Livy and Appian that 800,000 lbs. of silver was the total amount of tribute. He considers that the error was Pliny's. This seems so hard to believe that I have adopted Mayhoff's emendation, but Sillig may be right, as Pliny was capable of very gross errors (See note on par. 83).

folia has been considered corrupt by many editors, and no separate mention of leaves is made in H. N. 33, 137. *foliatam* is perhaps the most likely conjecture (Jan). The text may, however, be quite correct. For the golden vine, with its grapes of precious stones, cf. Athenæus (514f), and Herod. (7, 27).

$\overline{D}$. Ajasson rightly considers this figure extravagant. Perhaps the original reading was *D.*

craterem Semiramidis. Ctesias (Diod. Sic. 2, 9, 8.) attributes to the cup the colossal weight of twelve hundred Babylonian talents. Pliny implies that the weight was twelve hundred pounds.

colligebat. Cf. H. N. 2, 86, 186; 3, 67.

patere. Cf. H. N. 12, 53, '*schœnus patet Eratosthenis ratione stadia XL*', where *patet* has a much more natural meaning. Here the word seems to be equivalent to the sign of equality in our books of tables.

52. *Æetæ subolis.* Sillig and Mayhoff take *subolis* as a partitive genitive, but it seems more likely that, if it is correct, it is an old form of the nominative. Perhaps the conjecture of Voss, *suboles*, is right.

Suanorum. The Suani lived in Pontus. They are mentioned in H. N. 6, 14 and 30. In the latter case Pliny says, '*auri... metalla fodiunt*'.

Sesostri Ægypti rege. Mentioned in H. N. 6, 165 and 174. Bostock and Riley remark that the great king of Egypt would hardly have been *conquered* by Saulaces, but possibly he may have suffered a reverse on his Thracian expedition, his troops not being accustomed to the cold.

reges singulos. Bostock and Riley translate 'to select one of his vassal kings by lot'. This cannot be the meaning, for one king could not draw a chariot. Diodorus Siculus (1, 58, 2) says that *four* kings were yoked. The force of *singulos* may be that the lots came out one at a time.

53. *munere patris funebri.* The magnificence of these games in 65 B. C. was one of the main causes of Cæsar's debts.

vasis. An unusual use of the word. Harduinus conjectured *gesis* and other editors *hastis* and *verutis.* For the word in the more general sense, Sillig quotes Ulpian, (Dig. 33, 7, 8), '*vasa quæ utilia culturæ sunt, aratrum, ligones, sarcula, falces, bidentes.*' An even closer parallel is to be found in Gratius Faliscus, (Cyn. 218-19) '*nec sibi turbam Contraxit comitem, nec vasa tenentia longe*'. Here also *gesa* is unnecessarily conjectured.

in circo pegma duxit ff. The Desaint edition refers to Suetonius (Cal. 18). The account of Gaius' extravagances given there says '*minio et chrysocolla constrato circo*'. Either this was not the same occasion, or the account given by Pliny is a trifle exaggerated. The pegma was an edifice of wood with two or more stages, moved on wheels. It was sometimes used for the conveyance of gladiators or for firework displays, and seems to have been a frequent source of accidents. The reading $\overline{CXXIIII}$ is absurd. Even Gaius could hardly have put fifty-five tons of silver on a *pegma.*

54. *coronas aureas.* Cf. Livy 38, 37, 4. B reads $\overline{VII}$ and $\overline{VIIII}$ for the weights of the crowns, the other Mss. giving *VII* and *IX.* The former figures may well be correct, for these presentation crowns were not intended to be worn. Indeed the '*aurum coronarium*' was not always even in the shape of a crown.

Gallia comata. Transalpine Gaul, as opposed to *Gallia togata*, Cisapine Gaul.

Pompeii theatrum. The first stone theatre at Rome, opened in B.C.55. It suffered frequently from fire, and was restored after various conflagrations by Augustus, Tiberius and Titus. With reference to the occasion mentioned here, Dio Cassius (63, 6) says that not only the stage but all the surroundings and accoutrements were of gold, as a result of which the occasion was known as 'the golden day'.

aurea domus. Cf. H. N. 36, 111. '*bis vidimus urbem totam cingi domibus principum Gaii et Neronis, huius quidem... aurea*'. Nero's *aurea domus* was built after the burning of Rome. Far from being an ordinary house, it enclosed a vast extent of ground on the slopes of the Esquiline, and in the valley between that hill and the Palatine.

55. As is only natural, considerable manuscript variations exist in the figures of this section. For a full list, see Sillig's edition. The lacuna marked after *auri* by Detlefsen, Mommsen, and Mayhoff is demanded by the general sense of the passage.

56. $|\overline{CCC}|$. Sillig reads $\overline{CCC}$, but the reading of B is clearly correct in view of the statement that follows.

Æmilius Paulus. It was after the victory of Pydna, 168 B. C., that

Æmilius Paulus brought this enormous sum to the Roman treasury.

57. *laquearia.* On Roman ceilings, see Marquardt, Privatleben, 721 ff.

post Carthaginem eversam. Carthage fell in 146 B.C., and Mummius was censor in 142 B.C.

Catulo. Plutarch says that Catulus dedicated the Capitol after the death of Sulla. The dedication is mentioned in H. N. 19, 23.

58. *Primos inventores auri.* Pliny gives the various traditions on the subject in H. N. 7, 197. According to some, Cadmus the Phœnician was the discoverer, according to others Thoas, or Eaclis, or ‘ Sol Oceani filius ’.

quoniam longius fulget. Urlichs considers these words to be a gloss.

gemma. Sillig adopts this, the reading of B, in preference to *gemmis.* He observes that Pliny often uses singular for plural, e.g. 4, 31 ‘ *Penius, viridis calculo* ’, and 6, 172, ‘ *testudo plurima* ’.

59. *cedat per utrumque plumbo.* This statement, as it stands, is clearly wrong. Gold is denser than lead and more malleable. The specific gravity of gold is 19.5 and of lead 11.3. The Desaint edition points out that much of the ancient gold was impure and alloyed with silver and copper, and some of it may have been lighter than lead. The amount of impurity necessary to achieve the latter result would be very high, and we may conclude that either Pliny has made a grave mistake, or the reading is wrong. *Plumbum* for *plumbo* would make good sense. ‘ Gold is inferior to most metals in certain respects, although lead is inferior to gold. ’

uni nihil igne deperit. Pliny himself mentions asbestos (H. N. 19, 20). Gold is appreciably volatile at temperatures higher than the melting-point (1062°C).

obrussam. Cf. ὄβρυζον χρυσίον, ‘ pure gold ’ (Schol. on Thuc. 2, 13). For details of this test, v. Berthelot (op. cit. on par. 99), p. 38.

60. *accendi.* That *accendi* and *ardescere* refer to melting seems probable from the reference to fusion of gold in a straw fire in par. 94. It is not true that it is difficult to *heat* gold, the specific heat being very low (0.032). Gold containing silver would melt more easily than pure gold.

pruna. This old emendation from K seems necessary. *prunæ indomitum* is most difficult to translate, unless *indomitum* can be taken as ‘ impervious to ’, a sense construction.

palea. The use of chaff for the melting of gold is mentioned by Pliny H. N. 18, 99 and 33, 94, and by Plutarch (Symp. 3, 10, p. 658 D, ed. Xylander). Strabo (3, p. 146) gives a somewhat different account. He says that the flame of straw being ‘ soft ’, and more akin to the soft metal, melts gold, while charcoal ‘ destroys ’ too much. Pliny does not mention Strabo, who lived in the reign of Augustus, as one of his authorities, but possibly both scientists derived their information from a common source. It is not as improbable as it seems at first sight that a straw fire should have greater power of fusion than a charcoal fire, for straw contains some of the oxygen necessary for its own combustion, and in a suitable furnace might easily give a flame which would be hot enough for the purpose.

ut purgetur, cum plumbo coqui. This method is still in use and is termed cupellation. The alloy of gold and lead is heated in air on a bone-ash hearth. The lead is oxidised to litharge, which is removed, partly by blowing from the surface of the molten metal, partly by absorption by the bone-ash. Gold (and silver if present) remains in the cupel.

lineæ prædueantur. For the use of lead discs for ruling lines in manuscripts, see Marquardt, Privatleben, p. 824.

61. *Nec aliud laxius dilatatur.* Most commentators seem to assume that the gold-leaf of Pliny's time could not compare in thinness with modern gold-leaf. Beckmann (Hist. Inv. 2, p. 291 (Bohn)) is of this opinion, and remarks on the difficulty of estimating the thickness of the leaf here mentioned, owing to uncertainty about the conversion of ancient measures into modern standards. Bostock and Riley also say that the tenuity mentioned by Pliny is far surpassed at the present day and cite modern leaves « not more than one two hundred and eighty thousandth of an inch in thickness ». This thickness agrees well with that given by Roscoe and Schorlemmer, and by Carré in « Chimie Industrielle », viz. 0.000010 cms.

If we consider 1 *uncia* as 27.28 gms. and the specific gravity of gold as 19.3, and if we take ' four fingers ' as 7.5 cms., we find that the thickness of one of Pliny's 750 sheets was about 0.000034 cms. If the gold was impure and less dense (see note on par. 59), the thickness would be a trifle greater. Pliny's gold-leaf was then probably less than four times as thick as the best modern leaf.

Ajasson's note is incorrect, and he does not seem to know the size of the decimetre.

There are several references in Latin literature to the extreme thinness of their gold-leaf, e.g. Lucretius (4, 724 ff.) speaks of ' *simulacra rerum... tenuia... ut aranea bratteaque auri* ', and Martial (8, 33), holds up to scorn the thinness of a gold *phiala*. ' *Hac fuerat nuper nebula tibi pegma perunctum* '.

quaternum. Genitive plural.

Fortunæ. There are many references in ancient literature to the temple of Fortuna at Præneste and the oracle attached thereto.

retinente nomen... simulacro. The fame of the image ensured that the name *Prænestinæ* should continue to be given to gold-leaf.

quæstoria. This use is not noted by Lewis and Short. Was it because the Quæstors were treasurers of State? Mau, P. W. 3, 820 says that the name is unexplained.

62. *ramento.* Derived from *rado.* Cf. Plaut. Bacch. 4, 4, 29, '*patri omne* (*aurum*) *cum ramento reddidi.*' Here, as in Plautus (loc. cit.), the word means 'gold-dust', but in Lucr. 6, 1044, it probably means 'filings'.

robigo... ærugo. Robigo is derived from *robus*, i.e. *ruber*, and therefore means 'red rust', such as iron rust. *Ærugo* comes from *æs* and therefore means 'verdigris'.

63. *contra salis et aceti sucos domitores rerum constantia.* Many reagents that will attack gold are now known, the most important being solutions containing a halogen (chlorine, bromine or iodine), and those (such as 'aqua regia', a mixture of hydrochloric acid and nitric acid) which are capable of generating a halogen.

Verrius Flaccus. A very learned freedman, chosen by Augustus as tutor to his grandchildren (v. Nettleship, Essays in Latin Literature, p. 201). See on par. 111.

Agrippinam. Tacitus (A. 12, 56) and Dio Cassius (60, 33) mention the golden cloak of the Empress. The evidence is not consistent, as διάχρυσος, the word used by Dio Cassius, means that the golden threads were interwoven with some other material, while Pliny says explicitly '*aureo textili sine alia materia*'. Tacitus' adjective, '*aurata*', could probably have either meaning.

Claudii. 'Wife of Claudius', a genitive common in inscriptions.

Attalicis. It seems clear that Attalic cloth was embroidered with gold, not woven of gold. Cf. H. N. 8, 196, '*Aurum intexere in eadem Asia invenit Attalus rex, unde nomen Attalicis*', and 36, 115, where Pliny mentions that the theatre of Scaurus was adorned with Attalic cloth. Beckmann (Hist. Inv. (Bohn)) gives much information on the subject. Cf. also Marquardt, Priv. 535.

64. *leucophorum.* Cf. H. N. 35, 36 where Pliny tells us that this is made by mixing together half a pound of Pontic *sinopis* (red ochre), ten pounds of clear *sil* (yellow ochre), and two pounds of Greek *Melinum* (a white earth, v. H. N. 35, 37), and grinding together for twelve days.

argento vivo. Cf. H. N. 33, 99.

hydrargyro. Cf. H. N. 33, 123.

fraus. Pliny refers to the use of white of egg (Cf. H. N. 33, 100). Mayhoff omits *ut* before *dicemus*, and begins a new sentence with *Excogitata*, but this seems to imply that the *fraus* mentioned is the process described in the following section. This is clearly impossible.

65. *cruciatur.* Bostock and Riley take this to mean 'hammered'; but surely such treatment would not be accorded to an object which was to be gilded. The following *accensum* makes it probable that the word refers to heating. The operation is intended to ensure a clean surface.

in primis. In a private communication to the editor, Dr. D'Arcy W. Thompson suggests *in prunis*, which may quite possibly be correct.

examinatur. All Mss. have *exharenatur*, which occurs nowhere else and is taken to mean ' cleansed from sand '. But such a meaning is most improbable, for what copper surface to be gilded would contain sand? The emendation which is read in the text seems to give good sense. The surface is examined to see whether the cleansing operations have been successful, or whether they must be repeated.

exhalatur igni. Bostock and Riley translate ' is heated by fire ', a meaning which does not seem to be in the Latin. The phrase probably means ' is dried on the fire ', the moisture from the dipping being evaporated. Cf. '*pruina iam exhalata*' (Varro, R. R. 2, 2, 12). A second possibility is that *exhalatur* is used impersonally, ' it is breathed upon the fire ', i.e. ' the fire is blown up with the bellows '. That bellows were used in metallurgical operations is clear from H. N. 33, 108, '*accensa follibus*'.

mixtis pumice et alumine. A cleaning mixture, to give a final polish to the surface. Sillig punctuates as follows, '*ut possit edomitum, mixtis pumice, alumine, argento vivo, inductas accipere bratteas*'. This punctuation gives altogether the wrong meaning. For example, Bostock and Riley translate the passage as follows :— ' This done, it is again heated by fire, in order to enable it, when thus prepared, *with the aid of an amalgam of pumice, alum and quicksilver*, to receive the gold leaf when applied ' — a truly curious amalgam.

66. *Indicum a formicis*. Pliny relates (H. N. 11, 111) that when the ants had dug up the gold in winter the Indians stole it next summer. If the ants scented the Indians they pursued and caught them, even if they fled on swift camels. Cf. Her. 3, 102; Strabo 15, p. 706.

apud Scythas gryphis. Cf. H. N. 7, 10. '*Arimaspi... quibus adsidue bellum esse circa metalla cum gryphis, ferarum volucri genere quale volgo traditur eruente ex cuniculis aurum, mira cupiditate et feris custodientibus et Arimaspis rapientibus, multi sed maxime illustres Herodotus et Aristeas Proconnesius scribunt.*' Cf. Herod. 4, 27; Ælian. De Animal. 4, 27; Ctesias ap. Phot. Bibl. 72, p. 46 B 27, Bekker; Milton, P. L. 2, 943.

Tago. Gold-bearing sands mentioned also H. N. 4, 115.

Pado..., Hebro... Pactolo. Respectively the Po, the Maritza, and the Sarabat. For river-gold, cf. Ath. VI, p. 233 D.

Gange Indiæ. Desaint edition reads '*ut in Gange Indiæ*', considering that this is demanded by the words '*ut omittamus Indicum a formicis*'.

But Pliny is not excluding from his account 'Indian gold', but rather 'ant-gold'.

67. *puteorum.* Besides the usual meaning, 'well', Lewis and Short cite several other significations. The word means 'a pit for storing grain' in Varro, 'an air-shaft' in Vitruvius, and 'a dungeon for slaves' in Plautus.

ruina montium. Cf. '*ruinam naturæ*' (H. N. 33, 73).

segutilum. According to Ajasson, the surface earth of auriferous deposits was called *segullo* by Castilians in modern times.

Delmatia. East of the Adriatic Sea. Strabo (4, p. 208) quotes Polybius that gold was found, some in the metallic state, two feet below the surface among the Noric Taurisci. For use of water in such surface deposits, cf. Strabo, 3, p. 146.

68. *Cum ita.* The Desaint and Lemaire editions keep the old reading *gummi*, in the sense of an exudation from the crust of the earth over the metal.

cetero. Peculiar to Pliny. Used mostly in sense of 'otherwise', as in H. N. 10, 1, 3, 126; 11, 67 etc. (for fuller list see Sillig's note). For the order, cf. H. N. 8, 114, '*cetero animal simplex*', and 25, 157, '*cetero et has similes iridis*'.

hoc bono fertiles. All mss. read *huic*, but there is no evidence that *fertilis* can be used with the dative. Genitive and ablative are the usual cases. All four examples of dative given by the Thesaurus Linguæ Latinæ are *dativi commodi* and in no wise parallel to this.

canalicium. Cf. *canales* in following section.

non illo modo, quo in oriente sapphiro... Laurie (Greek and Roman Painting) considers that *sapphirus* usually meant lapis lazuli. This is very probable. Examples of lapis lazuli containing little yellow particles of iron pyrites are common, and it is not surprising that these were often mistaken for specks of gold. Cf. H. N. 37, 119, '*aureus pulvis ... in sapphiris*', and 37, 139, '*coralloachates guttis aureis sapphiri modo sparsa*'. *Thebaicus lapis* was probably a granite, and the 'gold' in this case may well have been glistening particles of mica, which often look like gold. Metallic gold in quartz usually appears rather like an efflorescence, quite unlike ('*non illo modo*') the sparkling particles of pyrites embedded in lapis lazuli.

69. *Vagantur hi venarum canales...* Diodorus (5, 36) and Strabo (3, p. 147) emphasise the devious nature of the galleries.

argentum quod exit a fornace sudorem. *Sudor* suggests that the substance indicated was a metal or metals which sublimed from the hearth on to the walls of the furnace and gave the appearance of having been sweated out. Silver would hardly volatilise to an appreciable extent under such conditions, so Ajasson is probably right in thinking that *argentum* means any bright metal, such as zinc, cadmium, mercury etc., which would volatilise easily.

scoria. No doubt the fusible slag formed in most metallurgical operations.

Catini fiunt ex tasconio. *Tasco* is Spanish for crucible or cupel. Crucibles, fire-bricks etc., are, still made from refractory clay.

similis. Sillig reads *simili* with T, giving a list of sixteen references (2, 31, 131, 151, 160; 6, 50; 8, 55; 9, 111; 11, 207; 23, 48; 24, 117; 26, 101; 29, 29; 34, 175; 36, 9, 76) to show that this is in accordance with Pliny's use of *hoc est*. Of these the only one which seems to favour *simili* is 29, 29. No such construction occurs in 8, 55 and in 2, 151 the words are *id est*, not *hoc est*. In 2, 131, (' *sine igne hoc est sine fulmine* ') the repetition of *sine* seems against rather than for Sillig's reading. The other references do not seem to the present editor to afford any help in deciding the question.

70. *opera Gigantum.* I.e. in heaping Pelion upon Ossa.

arrugiæ. Said to be connected with ὀρύσσω. The word still occurs in Spanish, according to Brotier.

atque purpuras. The words are only found in B. They may be a marginal gloss which has been introduced into the text, but, as such a comment does not seem very helpful, B is probably right.

71. *silices.* ' Flint ', by which *silex* is usually translated, now means a variety of silica, but *silex* was no doubt used of a number of hard rocks.

igne et aceto. Diodorus Siculus (3, 12 and 13) gives a similar account of mining operations, and Pliny mentions the same combination in H. N. 23, 57. One is inevitably reminded of the story of Hannibal in the Alps, told by Livy and Plutarch. Hardouin, in his note on this passage, adds that the device was used in his time by the Duke of Guise, on his Neapolitan expedition. These stories are no doubt due to a combination of two facts. Firstly, when cold water is poured on very hot rocks, the rocks are more or less disintegrated. Secondly, vinegar attacks slowly certain rocks of the limestone type. Probably the liquid used by Hannibal and by the miners was mainly water, to which some vinegar had been added in a half-scientific, half-superstitious way. The explanation offered by Blumner (Technologie 3, 71), although ingenious, can hardly be accepted. He suggests that holes were bored in the limestone, half-filled with vinegar, and stopped up. The heat of the fire above would than cause such a rapid evolution of gas as to amount to an explosion. In the event, however, of such a device being used, the bung would almost certainly offer less resistance than the solid rock, and would be blown out, the main mass being undamaged.

id cuniculos... strangulat. With this somewhat daring personification

Sillig compares the personification of *operæ* (H. N. 33, 73) and of *officinæ* (H. N. 34, 9).

fractariis. Sc. *Machinis.* The word does not occur elsewhere, but sounds genuine enough. It is supported by *iisdem malleis* in the following section. The readings of the early editors make little or no sense.

72. *cædunt.* Sillig adopts *cadunt*, the reading of B, adhering, as it seems to the editor, to even the mistakes of the good manuscript. Mayhoff went back to *cædunt* which is read by all the other manuscripts and gives a manifestly superior sense.

73. *voce, nutu.* Here B has a much better reading. Hardouin had already conjectured *nutu* from the mistakes of the inferior Mss.

operas. For *operarios*, read by one Ms. only — obviously a gloss inserted in the text.

ab sese. 'Of its own accord', 'under its own weight'. Cf. '*ipsum a se oritur et sua sponte nascitur*', Cic. Fin. 2, 24, 78. Another possible way is to take *ab sese* closely with *longe*, — 'the mountain falls right away from itself', i.e. 'leaves a huge hole'.

æque et flatu. Here again Sillig keeps to the reading of B, *eque efflatu*, omitting the full stop after *incredibili*, and quotes numerous examples to prove that *ruinam ex efflatu* is a type of expression usual in Pliny. But the *ruina* was not a result of the *efflatus*, rather the *efflatus* of the *ruina*. *Efflatus* occurs nowhere else, and the reading *æque et flatu*, to which Mayhoff reverts, seems preferable.

foderent. Subjunctive of indefinite frequency.

74. *corrugos.* The derivation from *corrivatio* seems so improbable that Dalechamps suggested that the true reading was *corrivos*. It appears however that *corrugo* in Castilian means 'canal à laver les mains', so the word, which is no doubt akin to *arrugia* (H. N. 33, 70) and ὀρύσσω, is probably quite correct, and Pliny was mistaken in his derivation.

libramentum. The word used by the younger Pliny in his well-known reference to the periodic spring (Ep. 4, 30, 10), where the meaning of the word is more obscure than in this instance.

ut ruat verius quam fluat. Sillig aptly compares H. N. 5, 54, '*non fluere... sed ruere*'.

substructis. Where the canal crossed a gap, it was supported from below with poles or arches.

ferarum. Desaint edition reads *ferorum* (i.e. 'savages') without manuscript support.

alitum. Bostock and Riley quote the quaint translation of Philemon Holland, 'some flying spirit or winged devill of the air'.

75. *librant.* This verb means 'to take levels' in Vitruvius also.

quaque insistentis... importet. This passage illustrates clearly the superiority of B over the other Mss. The passage was quite unintelligible to the early editors, of whose texts the following is a fair example, '*Itaque insistentis vestigiis hominis locus non est. Manus trahunt omne vitium in sportis*'.

vitium lavandi et. Detlefsen, Urlichs and Mayhoff read the conjecture *est* for *et*. This seems quite unnecessary. The previous paragraph dealt with the difficulty of constructing the pipe-lines. Pliny now passes on to the next difficulty, that of the *urium*, and *et* is quite in place.

opturamentis. This cannot mean a thin wall of earth which is eventually broken down by the water in the reservoir, the view taken by some editors. The operation would have to be repeated a large number of times, so the *opturamentum* must be a replaceable flood-gate. The word is used of an artificial bung in H. N. 16, 34, '*cadorum obturamentis*'.

saxa provolvat. Bostock and Riley translate 'roll onward any fragments of rock which may obstruct its passage'. This is clearly wrong. *Saxa* refers, not to chance rocks in the way, but to the gold-bearing debris loosened by the miners, which is being washed out into the sluice-boxes.

The use of water to wash out gold-bearing debris is still common in the gravel deposits in California, Australia etc. The account of modern hydraulic mining in Eissler's « Metallurgy of Gold » is not unlike that given here by Pliny. The necessity, not only of a good head of water (as in par. 74), but also of securing an outlet for the tailings (as in par. 76), is emphasised by Eissler. In some cases valuable mines have been closed owing to the impossibility of getting rid of the debris.

76. *gradatim.* I.e. the channels descended by 'steps' or sluice-boxes, which were strewn with *ulex*. Sluice-boxes are mentioned by Agatharchides in his description of Egyptian mining (ch. 11, pp. 727-9).

ulice. If the shrub was like rosemary, it cannot have been the modern Ulex Europæus or gorse.

latera. The Desaint edition reads the unnecessary conjecture *lateres*, and pictures a complicated arrangement for catching the gold.

labetur... in mare. The omission of this line in many Mss. is clearly due to the occurrence of the words *in mare* at approximately the same point in both lines.

rigantur. Cf. Livy 5, 16, 9 (Weissenborn), and H. N. 11, 182.

77. *palagas... palacurnas.* Cf. Strabo, 3, p. 146.

balucem. For *balluca*, used of gold, see Codex Theodosianus, 10, 19, de Met. 3 (note by Gothofredus), and cf. Martial 12, 57, 9 (Conj. Turneb. Salmas.).

78. *Asturiam.* A province in Hispania Tarraconensis, now part of Portugal.

Gallæciam. Also in Hispania Tarraconensis, cf. par. 80.

Lusitaniam. Western Spain. It included a large part of the modern Portugal.

Italiæ parci. Cf. H.N. 3, 138. '*Metallorum omnium fertilitate nullis cedit terris; sed interdictum id vetere consulto patrum Italiæ parci iubentium*'; also H. N. 37, 202.

Victumularum. Hermolaus Barbarus conjectured *Ictimulorum* in accordance with Strabo 5, p. 218, who says that Vercellæ and Ictimuli were both near Placentia, in Cisalpine Gaul. See Bunbury's note in Dict. of Greek and Roman Geography (Smith); also Corpus Inscr. Lat. 5, 715.

publicani. A general name for those who took State contracts.

79. *auripigmento.* Orpiment, i.e. yellow arsenious sulphide, As_2S_3. It is mentioned by Vitruvius 7, 7, and Celsus 5,5, both of whom give ἀρσενικόν as an equivalent. Hence our word ' arsenic '. The Greek comes by metathesis from *az-zarnikh* = Persian *zarnikh*, orpiment (*zar*, gold + Arabic *al*, the : Bailey — Etymological Dictionary of Chemistry and Mineralogy). The use of orpiment as a paint is mentioned in H. N. 35, 49.

auri colore, sed fragile. Sillig punctuates after *fragile* and not after *colore*. The present punctuation seems preferable, as there is no reason to believe that *lapis specularis* was usually yellow.

lapidum specularium. Cf. H. N. 36, 160 ff. In most cases this seems to indicate mica, which was used for windows (though glass windows have been found at Pompeii and Herculaneum). It was sometimes confused with gypsum, which has a similar cleavage into plates. The *lapis specularis* from which plaster was made (36, 183) was gypsum, and bones of animals were turned into gypsum, not mica (36, 162). The substance, however, which could support heat and cold, and which was strewn on the Circus Maximus (36, 162) was evidently mica.

fecit aurum excellens. Orpiment itself could, of course, give no gold. Two explanations are possible. Either the orpiment occurred in a gold-bearing soil or, as seems much more probable, Gaius was the victim of a trick. No doubt some merchant who had a large stock of orpiment on hands thought it worth his while to ' salt ' the first consignment with a little gold in the hope of securing further large orders. If so, he sacrificed his gold in vain.

nec postea temptatum. Even in 1929 A. D., an Austrian tinker is said to have obtained over a quarter of a million pounds by false claims to be able to make synthetic gold.

80. *Gallæciæ.* Sillig's conjecture seems justified by the mention of Gallæcia in par. 78.

Albucrarense. Probably the same as Albocola, north of Salamanca.

electrum. The Greek ἤλεκτρον means amber, as well as the alloy which resembles it in colour. It may be connected with ἠλέκτωρ, ' the sun '. Isidor. 16, 23 says that electrum contains one-fourth silver.

canaliensi. Cf. H. N. 33, 68.

fit et cura electrum. Artificial electrum is also mentioned in H. N. 9, 139.

81. *Homero teste*. Odyssey 4, 71.

Minervæ templum habet Lindos. Cf. H. N. 19, 12.

venena deprehendit. The same incredible story is to be traced in the works of Q. Serenus Samonicus (1057), who was *præceptor* under the younger Gordian— '*produnt electri variantia pocula virus*'. Cf. also Isidor. 16, 24, 3.

82. *inanitate*. Sillig follows B in reading *vanitate*. He defends the reading by saying that, though *vanitas* is not elsewhere found with the literal meaning 'emptiness', instances of *vanus* in this sense are plentiful in lexicons. He considers *inanitate* as a gloss. A reference to Lewis and Short shows that, even in the cases where *vanus* is considered to be used literally, there is almost always a shade of derived meaning. This is obvious in such cases as '*seges vanis elusit aristis*' (Virg. G. 1, 226) and '*leve ac vanum granum*' (Col. 2, 9, 13), the first two quoted in the lexicon. *Inanis*, on the other hand, is often used of physical emptiness, e.g. '*cum vas inane dicimus... ita loquimur ut... sine aqua, sine vino, sine oleo vas esse dicamus*' (Cic. De Fato, 11, 24).

modo. The adverb, not the substantive. See Sillig's note.

holosphyraton. Lewis and Short mention no other instance of the word in Latin. For ὁλοσφύρητον in Greek, see Anth. Pal. 11, 174, 3. The usual Greek is σφυρήλατον.

Anaitidis. Anaitis seems to have been a Persian goddess, (perhaps equivalent to Ishtar), sometimes identified with Artemis or Aphrodite. (For further information see Frazer's 'Golden Bough'.) Pliny mentions Anaitica in Armenia (H. N. 5, 83,), and the excellence of the Papyri growing round the Anaitic lake (H. N. 16, 157).

verumne esset. I have adopted this conjecture, believing that the words fell out owing to the preceding *esset*, and were replaced in various ways to make the sense complete.

83. *cum maxime*. For this use, cf. H. N. 19, 128 and 9, 121.

hominum primus. At first sight the phrase seems to mean that Gorgias was 'the first of men' to set up a gold statue. That this is not so is clear on a closer inspection. There is a contrast between *omnium* at the beginning of par. 82 and *hominum*.

auream statuam et solidam... Gorgias... posuit sibi. Val. Max. (8, 15, ext. 2) says that the statue was erected by the whole of Greece in honour of Gorgias. According to Paus. (10, 18, 7) it was gilded, but Athenæus (11, p. 505, ed. Casaubon) calls it χρυσοῦς, and Cicero (De Orat. 3, 32, 129) gives the explicit information '*non inaurata statua, sed aurea*'.

LXX circiter olympiade. Gorgias visited Athens in 427 B. C. This makes the seventieth Olympiad (500-496 B. C.) seem most unlikely as the period of the dedication. The ninetieth Olympiad (420-416 B. C.) seems more likely, and Bergk has actually conjectured *LXXXX*. It is not probable that the mistake occurred in copying the Latin manuscript. A more likely explanation has been suggested to me by Dr. J. G. Smyly. The difference between seventy (o) and ninety (ϙ) in Greek alphabetical numerals is small, and on the worn base of a statue might be negligible. It seems probable that the Greek authority, from whom Pliny took the story, copied the inscription wrongly, and that Pliny, who must surely have known the real dates of Gorgias, nevertheless carelessly transcribed the account as he found it.

84. *superlato*. For similar use of *superfero*, cf. H. N. 28, 103 and 32, 133. In the former passage, as here, *superlatum* and *illatum* seem to be interchangeable.

misyos. Cf. H. N. 34, 117, 121. Brongniart (Ajasson edition) and Stillman consider, no doubt rightly, that it was a more or less oxidised pyrites, containing sulphates of iron and copper. The chemical significance of the operation described is obscure. The Desaint edition suggests that the *sal* mentioned was our nitre, and that silver nitrate was formed and was the caustic principle in the *reliquus cinis*. Stillman, with more probability, considers *sal* as sodium chloride, and compares the operation to the now obsolete cementation process for removing silver from gold. In this the metal was heated with a mixture of two parts brick-dust and one part common salt for thirty-six hours. The silver was all converted into silver chloride and could be removed by washing. For similar ancient recipes, in the Leyden Papyri, v. Berthelot (op. cit. on par. 99, pp. 14, 31, 35). Hœfer (Histoire de la chimie, p. 117, quoted by Thompson, Chemistry of Ancient Assyrians, sect. 37) suggests that hydrochloric acid was the active agent, produced by roasting together sodium chloride and ferrous sulphate.

schiston. A term probably used to denote various minerals of lamellar structure.

Ita virus. The punctuation and therefore the meaning of this passage is in dispute. Sillig reads '*ita virus trahit rebus una crematis in fictili vaso ipsum purum et incorruptum*, *relicus cinis servatus in fictili olla ex aqua inlitus lichenas in facie*; *lomento eo convenit ablui*'. The main difficulties, if this punctuation is adopted, lie in the last phrase. What is the *lomento*? Why *eo*? What does *ablui* mean? Bostock and Riley translate 'it is applied with water for the cure of lichens on the face: the best method of washing it off is with bean-meal'. This neglects *eo* and seems to make the use of 'bean-meal' part of the treatment.

Mayhoff reads, '*ita virus trahit rebus una crematis in fictili vaso*, *ipsum purum et incorruptum*. *Reliquus cinis servatus in fictili olla ex aqua illitus lichenas in facie-lomento eo convenit ablui-*,*fistulas etiam sanat et quæ vocantur*

hæmorroides ', bringing *sanat* into the sentence to govern *lichenas*. The reading and punctuation adopted in the text seem to give reasonably good sense, and *qua* and *illatas* are found in B. The *lomentum* is then the same as the *reliquus cinis*, and *ablui* refers to the main healing operation. That *lomentum* does not always mean ' bean-meal ', but is used of other powders, is clear from H. N. 33, 89 and 162f., where there is reference to a *lomentum* made from *cæruleum*.

85. *pumex*. For use of *pumex* in medicine, see H. N. 36, 156. Dioscorides (5, 125) gives a similar account. Dioscorides dedicated his Materia Medica to Læcanius Areius of Tarsus, a friend of C. Læcanius Bassus, who was consul in 64 B. C. He must, therefore, have been a contemporary of Pliny. Much of his chemical information is almost identical with that given by Pliny. As Pliny does not mention Dioscorides in his list of authorities, it seems probable that both drew from a common source, perhaps Sextius Niger, as has been suggested by Wellmann.

melanthio. Probably camomile. Cf. H. N. 20, 182; 22, 53.

auro verrucas curari. The Desaint edition suggests that the real curative agent here, as also in the ringworm-removing ointment of the previous section, was silver nitrate, or some silver salt derived from silver occurring in the gold. The powers of silver nitrate are evident from its old name « lunar caustic ».

86. *Chrysocolla*. The identity of *chrysocolla* has been a matter of some dispute. The use from which the name is derived (v. par. 93) suggested that it was borax, a meaning still given by Lewis and Short, while Ajasson held that the chrysocolla strewn on Nero's arena was yellow mica or talc. Both these views are clearly wrong.

Dioscorides (5, 104) gives an abbreviated account, probably drawn from the same source as Pliny's. He says that *chrysocolla* was *τῇ χρόᾳ κατακόρως πρασίνξουσα*, which probably means ' of a full leek green ', and no doubt refers to the colour of the original mineral, as he makes no mention of the dyeing operation described by Pliny (par. 88). He puts Armenian, Macedonian and Cyprian *chrysocolla* in descending order of merit, and mentions the uses for removing scars, as a purgative, etc.. Isidorus (Orig. 19, 17) says that *chrysocolla* is a product of copper mines, and when found in gold and silver mines is due to the presence of copper. Aristotle (Auscult. Mirab. 58) mentions its use in eye treatment (cf. par. 92), a use probably familiar to the ancient Assyrians also (cf. Thompson-Chemistry of the Ancient Assyrians, sect. 35).

The usual identification with malachite, or basic copper carbonate, is clearly correct, though it is quite possible that other copper minerals such as the modern chrysocolla (a silicate of copper) are included under the name. In a long note in the Desaint Edition, M. Guettard states that mountain-green (malachite) was produced in the copper mines of Herren-Grund and Huges in Hungary in the way described by Pliny. He made some experiments on soldering with malachite, and showed that it could be used as a solder for gold.

The dyeing process described in par. 88 seemed worthy of investigation, and the present editor prepared an extract of weld (*lutum*). Finely-powdered malachite (bluish-green) was boiled with weld and (a) aluminium sulphate, (b) ferrous sulphate, or (c) iron alum. With (a) a fine emerald green powder (*colorem in herba segetis læte virentis*) was obtained, while with (b) and (c) the pigment was a dark bottle-green. The emerald green was a beautiful colour, far superior to that of the original malachite. These experiments also shed some light on the identity of *alumen*, and make it probable that some varieties of *alumen* were salts of aluminium, though those which gave a black colour with pomegranate juice and nut-galls must have contained iron, and were possibly sulphates of iron produced by the oxidation of pyrites. (See ‘ Nature ’, 1925, p. 764.)

puteis quos diximus. H. N. 33, 66.

vilior autem auraria. Auraria may be ablative, ‘ less valuable than that found in gold-mines ’, or nominative, ‘ that found in gold-mines is less valuable ’.

multum infra naturalem illam. The steady stream of water would of course carry much with it besides genuine *chrysocolla.*

87. *uvam.* Only here in this sense. The early editors read the conjecture *luteam*, evidently considering *uva* to be a ridiculous name for *chrysocolla.* The name, however, is a perfectly natural one for certain forms of malachite, which often occurs in botryoidal masses. Specimens in the Geological Museum of Trinity College, Dublin, bear a strong resemblance to bunches of grapes. Cf. the use of *uva* with reference to *chalcanthon* (H. N. 34, 123).

lutum. Probably weld (*reseda luteola*), the pigment of which is luteolin or tetrahydroxyflavone.

88. *ex aceto.* Some of the hard particles of malachite would be converted into acetate of copper.

conchis. Shell-shaped vessels are mentioned by Horace and other writers. Possibly actual shells were used.

alumine schisto. Schisto no doubt refers simply to the physical condition of the substance. Aluminium sulphate and the alums are frequently employed as mordants in modern dyeing. See note on *chrysocolla* (par. 86).

scytanum atque turbistum. Nothing is known as to the identity of these mordants. Cf. H. N. 35, 150 on use of different mordants with same dyestuff to produce different colours.

89. *orobitin.* Hardouin suggests that the name is derived from *orobus*, the vetch, because the pigment was made up into little balls, the *globuli* mentioned below.

lomentum. A *lomentum* made from *cæruleum* is mentioned in H. N. 33, 162. This is no doubt a similar pigment.

globulis sudore resolutis. Bostock and Riley translate 'the balls being dissolved for use by evaporation'. This seems a very inaccurate use of the word 'evaporation'. Also, it is quite clear that *chrysocolla* was insoluble in water. *Sudor* is sometimes used of water or liquids in general, e.g. *sudor maris* (Lucr. 2, 465), *sudor veneni* (Ov. Met. 2, 198). No doubt the paint was made up in two forms. The *eluta* was the washed and dried powder, which was perhaps made up into *globuli* and sold as such. The *liquida* was the pigment sold ready for use, the little balls having been ground and made into a suspension (*resolutis*) with some liquid, probably oil (*sudore*).

laudatissima... in Armenia. Dioscorides (5, 124) gives the same order of merit.

largissima. Ajasson translates 'la plus riche en partie colorante'. This seems rather much to understand from *largissima.* Surely it means 'the greatest yield'?

90. *harenam circi chrysocolla sterni.* This was not unprecedented. Suetonius (Calig. 13) says of one of the spectacles of the Emperor Gaius, '*minio et chrysocolla constrato circo*'. Ajasson suggests that this chrysocolla was yellow mica or talc, but below we read that Nero was to drive *concolori panno*, and we know that his colour was green. He favoured the *Prasini*, (see indirect reference in Mart. 13, 78) as did Caligula before him ('*prasinæ factioni addictus et deditus*', Suet. Calig. 55).

indocta turba. No doubt in contrast to artists.

asperam... attritam. The price list is a curious one. It would seem more natural for the 'rough' chrysocolla to be the cheapest, not the dearest. It seems possible to the editor that *asperam* and *attritam*, which would occupy approximately corresponding positions in two successive lines, may have become transposed.

harenosam. The meaning of this word is uncertain, though it may refer to the *aspera* chrysocolla. Mayhoff conjectures *herbaceam* or *harenatum*, the latter being a sand-mortar, mentioned by Vitruvius (7, 4) and Pliny (H. N. 36, 176f). The sense, if the latter conjecture be adopted, is still far from clear. For *harena* of hard pigments, cf. pars. 113, 114, 120 and 161, and note on '*limus est*' (par. 158).

91. *Parætonium.* Cf. H. N. 35, 36, '*Spumam maris esse dicunt solidatam cum limo, et ideo conchæ minutæ inveniuntur in eo*'. The description suggests common chalk (carbonate of calcium), in which shells are frequently found. Vitruvius (7, 7, 3) says that it is named from the locality where it is found.

pinguissimum. ‘ Bland ’ or ‘ unctuous ’. The same word is used of lime in H. N. 36, 174.

atramento. This word was no doubt applied to any black substance. Probably the body meant here was animal or vegetable black, such as is described in H. N. 35, 41-3, as distinct from *atramentum sutorium* (H. N. 34, 123; etc.).

quam ipsam cæruleo subtritam. Cf. Vitruvius (7, 14, 2), ‘*Qui non possunt chrysocolla propter caritatem uti, herba quæ lutea appellatur, cæruleum inficiunt, et utuntur viridissimo colore*’.

92. *Usus chrysocollæ et in medicina.* The use of copper in medicine is diminishing, but it is still employed occasionally in most of the cases mentioned by Pliny. The British Pharmacopeia gives directions for solutions of copper sulphate to be used as an astringent or as an emetic. Dioscorides says that in the latter case its use was sometimes attended by fatal results. Copper sulphate is still in use for removal of « proud flesh », and both sulphate and citrate are made up in pencils for eye work. The use of chrysocolla for remedying sores on the eyes is mentioned by Aristotle (Auscult. Mirab. 58).

Datur et in angina. Dioscorides (Parab. 1, 88) gives the same prescription.

cicatrices trahendas. The Desaint edition reads the conjecture *tergendas* on the strength of *δύναμιν ἔχει σμηκτικὴν οὐλῶν* (Dioscorides 5, 104). *Trahendas* gives good sense, and no doubt Dioscorides did not make a literal translation of Pliny (v. note on par. 85).

acesin... quæ non est orobitis. What the difference was we do not know. Possibly the copper compound employed was the same in each case, and the difference lay in the method of making up. Hardouin derives *acesis* from *ἀκέομαι*, to cure.

93. *inde omnes appellatas similiter virentes dicunt.* The reading of the early mss. and editors, ‘ *inde omnes appellatam similiter utentes dicunt*, ’ seems almost meaningless. For example, Ajasson translates ‘ De là même le nom générique de chrysocolle ’, a rather free version, to say the least of it.

Temperatur... Cypria ærugine. ‘It is mixed with Cyprian verdigris’. Cf. ‘ *acetum melle temperabatur* ’ (H. N. 14, 114). The other translation, ‘ It is made by mixing Cyprian verdigris with... ’, seems wrong. It would require ‘ *ex Cypria ærugine* ’. Cf. Cic. N. D. 3, 14, 36, Cic. Off. 3, 34, 119.

urina. V. Berthelot (op. cit. on par. 99), p. 46.

nitro. Galen and Dioscorides (5, 92) omit *nitrum* from the recipe for *santerna. Nitrum* was probably sodium carbonate, not our nitre. For *nitrum* see H. N. 31, 106-122, etc.

santernam. In H. N. 34, 116 Pliny says that the uses of *santerna* were the same as those of *ærugo* or verdigris.

ita feruminatur aurum... glutinum fit auro et septima argenti parte. Alloys of copper, silver and gold are in use as gold solders. No doubt in soldering with chrysocolla some metallic copper was deposited and presented a clean metallic surface suitable for union.

94. *Auro glutinum est tale ff.* The soldering materials given here are unclassified, some forming part of the joint, some acting simply as cleaning materials or as fluxes. *Alumen*, no doubt, was a cleaning material. Resin is still used as a flux for soft alloys, and oil for pewter and Britannia metal. Cf. H. N. 34, 158.

Cadmea. Cf. H. N. 34, 100, ff., where several varieties obtained as sublimates in the roasting of copper ores are described. There can be little doubt that this *cadmea* was zinc oxide. That which is described in H. N. 34, 2 was a natural mineral, perhaps calamine.

stagnum. An alloy of lead and silver, and not tin. Cf. H. N. 34, 159. Mayhoff reads *stagnum*, which is given by all the best mss. in preference to *stannum*, as also in H. N. 33, 130 and 34, 159. In Suet. (Vit. 5. fin.) *stagnum* occurs, as also in Isidor. (Origg. 16, 23, 2). Corpus Glossarum (2, 544, 39) gives *stagnum*, *κασσίτερος*. Cf. also modern Italian *stagnio.*

Blumner (Tech. 4, 81-2) quotes the view of Schade that *stagnum* originally meant ' tin ', but that the word became appropriated to crude lead, used in cheap wares as a substitute for tin, the latter getting the new name of *plumbum album.* Schade also thinks that in H. N. 34, 160 (*stagnum illitum æreis saporem facit gratiorem ac compescit virus æruginis*) *stagnum* actually means ' tin '. In view of the occurrence of the words *plumbum album* in the same paragraph, this seems unlikely.

Ægyptio papyro. Papyrus was sometimes masculine, sometimes feminine. Hence the variants.

Calx aqua accenditur. That *calx* was our quicklime is clear from passages in Vitruvius. E.g., of the burning of limestone to get lime he says, ' *de calce diligentia est adhibenda uti de albo saxo aut silice coquatur* ' (2, 5).

Thracius lapis. The identity of this substance is uncertain. Its association with *calx* would lead one at first to suppose that it was an analogous substance, perhaps quicklime obtained from another type of limestone, but it seems clear from a passage in Aristotle that this is not so and that it ' *accenditur aqua* ' in a manner quite different from lime. Aristotle says (Mir. Auscult. 115, 841a, 29ff) that there is a river in Thrace called Pontus which rolls along certain stones, differing markedly in combustible properties from wood charcoal, for they are put out by a draught but blaze more brightly when sprinkled with water. He remarks a resemblance to burning asphalt, and that creeping things shun the neighbourhood where they are burning. Nicander (Ther. 45, ff) says of this substance that it blazes up when wetted with water, and adds that it may be quenched with olive oil. No substance which *spontaneously* inflames or heats on contact with water could exist in the bed of a river, and it is evident from Aristotle's account that it was first kindled by application of heat. If water was then sprinkled upon it, it was not extinguished. This suggests an oily shale, which would give off a good deal of inflammable gas. Most shales contain sulphur compounds, the combustion of which would cause a smell, and in any case the smell of any oily substance burning might be described as resembling that of asphalt or bitumen.

Is is possible, indeed, that Thracian stone was simply a variety of asphalt. '*Serpentes accensum* (sc. *bitumen*) *nidore fugat*' (H. N. 35, 180) reminds us of Aristotle's account. Cf. H. N. 2, 235. It seems less likely that it was a rock containing small amounts of some compound such as phosphide of calcium or carbide of iron which, under the combined action of heat and water, would give off an inflammable gas (phosphoretted hydrogen or acetylene). Philemon Holland identified Thracian stone with coal, and Bostock and Riley, misled by the inaccurate brevity of Pliny — as judged by the account given by the more painstaking Aristotle — laughed at his simplicity, but the early translator was not as far from the truth as Bostock and Riley who, by translating *calx* by 'limestone', have been guilty of a very elementary mistake.

Dana (System of Mineralogy, 6th Edn., p. 1024) identifies Thracian stone with brown coal.

The one thing that seems certain about Thracian stone is that Pliny's account of it is misleading.

aceto... visco... ovo. Cf. H. N. 29, 51 '*ut lignum perfusum ovo non ardeat ac ne vestis quidem contacta aduratur*'. This curious list deserves notice. The passage quoted from Bk. 29 makes it clear that the reference is not to putting out a fire by throwing (e. g.) eggs at it, but to the fire-proofing effect of egg-white. The writer has investigated the effect of dipping a stick, a piece of cloth and a piece of cotton wool in white of egg, drying and exposing to a flame. In each case combustion was much retarded. The cotton wool charred slowly and could be heated red hot without bursting into flame. When comparison was made with cotton wool fire-proofed with sodium tungstate, the latter piece inflamed more easily. The action of bird-lime from mistletoe is no doubt similar. The disadvantages of either substance as a permanent fire-proofing medium are obvious.

Vinegar, on the other hand, is no more efficient than ordinary water for checking combustion. Its inclusion in the list must be due to remembrance of some particular experiment in which, for example, vinegar flowed on to chalk, liberating carbon dioxide, and fire was extinguished by this heavy gas which is, of course, a non-supporter of combustion.

carboni vis maior exusto iterumque flagranti. Cf. H. N. 36, 201, '*Ipse carbo vires habere incipit restinctus atque interiisse creditus maioris fit virtutis*'. The first burning was no doubt that of wood to give charcoal. We use in a similar way the word 'charcoal-burner' to mean 'one who burns wood to charcoal'.

95. *sequens insania.* I.e. after gold.

alias rubra, alias cineracea. Blumner (Technologie 4, 143) quotes the opinion of Frantz that the *rubra* is pyrargyrite (a double sulphide of antimony and silver), and the *cineracea* tetrahedrite (an argentiferous complex sulphide) or galena (argentiferous lead sulphide). Zippe (quoted loc. cit.) thinks the *cineracea* was argentite (silver sulphide).

galenam. Galena, or sulphide of lead, is usually argentiferous, and is one of the most plentiful sources of silver at the present day.

References to the occurrence of silver in galena are found in H. N. 34, 159 and 173.

discedit pars in plumbum. This no doubt refers to the solution of the silver in the lead, from which it is recovered when the lead has all been oxidized to litharge, which is either absorbed by the hearth or blown off the surface. This method of cupellation is still in use.

Mayhoff in reading *discedit* with B, compares *discedat* in par. 99.

argentum innatat superne. This must refer, not to the actual silver, but to the layer of shining molten litharge. The error, if it be an error, is curious in view of the description given in par. 107 of the manufacture of litharge.

96. *id quoque.* I.e. like gold. Cf. par. 68.

metalla. Pliny therefore derives the word from μετ᾽ἄλλα, 'one after another'.

ab Hannibale inchoatos puteos. Bostock and Riley note that in the hills north of Linares in Spain, old silver mines are still called 'Los Pozos de Anibal'.

97. *hodieque.* For this use, cf. H. N. 8, 176; 30, 2.

ad MD passus iam cavato monte. This sounds more like *arrugiæ* than *putei*, in spite of par. 95.

Aquitani. The Aquitanians lived, not in Spain, but in Gaul. This has given rise to several conjectures, of which the most tempting is the *aquatini*, 'water-carriers', of Sillig. This word, however, does not occur elsewhere. The Aquitanians may have been imported to work in the mines, a practice not unknown in modern times.

lucernarum mensura. Cf. par. 70.

crudaria. Bostock and Riley translate 'raw silver', Ajasson 'veine crue'. The Desaint edition says that *crudaria* is *cruda ria.* (*Ria* in Castilian means 'mouth of a river'.) Is it possible that the meaning 'red' is present (*crudus* contains the same root as *cruor*)? Cf. par. 95, '*terra est alias rubra*'.

98. *Alumen inventum.* What this 'alum' was it seems impossible to decide. For *alumen*, cf. H. N. 35, 183 ff. The name was probably applied to many substances of an astringent nature, of which one was certainly ferrous sulphate (green vitriol,) derived no doubt from the oxidation of iron pyrites. This is clear from the fact that one variety of alum gave a black colour with nutgalls and pomegranate juice. Another variety was probably aluminium sulphate (v. note on par. 88).

nullam. See critical note. *Albam* (VR) was probably a corruption of *nullam*, the latter word, which is necessary for the sense, being reintroduced as *nullum* in h. For the gender of *finis*, v. note on par. 3. '*Æris vena alba*' does not seem a suitable description of any ore of copper.

Odor. The only likely suggestion is that given by Stillman, that we have here a reference to carbon dioxide, which would cling close to the floor and so be more dangerous to small animals like dogs. Xenophon (Mem. 3, 6, 12) refers to the unhealthiness of the silver mines at Laurium.

Aurum... quo mollius. Pure gold is so soft that it is never used unalloyed in coins or in jewellery.

Lineas ex argento nigras. Most metals (with a few exceptions such as magnesium) are black when in a fine state of subdivision. Cf. par. 60.

99. *aeterni.* In contrast to water which, by reason of its lower boiling point, evaporates much more readily.

argentum vivum. The ἄργυρος χυτός of Aristotle. Native mercury is found in globules disseminated through the cinnabar in the Palatinate, Peru, and other countries. Vitruvius (7, 8) says that the cinnabar gives up some mercury under the blows of the diggers. On heating in an oven, more mercury is obtained in droplets. Cf. H. N. 33, 123 and Note. Metallic mercury has been found in fair quantity, with limestone and cinnabar, in the ruins of a Maya city of the fourth century A. D. Gann, Ancient Cities and Modern Tribes, 1926, p. 183.

venenum rerum omnium est. Ajasson translates *venenum* by 'dissolvant universel', objecting that mercury is not itself particularly poisonous, though its salts are. But mercury does not dissolve all things, even if *venenum* could mean this. Dioscorides (5, 110) says that mercury penetrates the intestines by its weight. It may, however, be swallowed with impunity.

perrumpit vasa. The mss. of Dioscorides (5, 100) contain the statement that mercury can be preserved in vessels of glass, silver, lead, or *stagnum* (for *stagnum*, v. note on par. 94).

Of these, glass is the only suitable material, and the Leyden Papyrus X, examined by Berthelot, wich contains ten paragraphs drawn from Dioscorides, omits silver, lead and *stagnum*. As Berthelot remarks (Introduction à l'étude de la chimie des anciens et du moyen age, 1889, p. 27), this proves that glass was the only material mentioned by Dioscorides, the others having been added by an ignorant commentator.

subactas. Cf. *subigere corium pilis* (Cato R. R. 18, 7.).

purum relinquit aurum. Vitruvius (7, 8) says '*cum id in pannum infunditur, et ibi manibus premitur, argentum* (sc. *vivum*) *per panni raritates propter liquorem extra labitur, aurum compressione coactum intra purum invenitur*'. Neither author seems to realise that you would obtain, not pure gold, but an amalgam from which the mercury would have to be driven by heat.

100. *cum aera inaurentur*. Beckmann remarks that Pliny did not understand gilding very well, an opinion with which we must concur. This passage seems to suggest that the excess mercury remains under the gold-leaf, which is of course impossible. In amalgam gilding, however, the film which has been heated to drive off mercury often retains a little mercury and has a dull colour till burnished. This is, no doubt, the phenomenon referred to by the words, '*pallore detegit simplices aut praetenues bratteas*'.

Hydrargyrum. With some hesitation I have adopted this conjecture from the Desaint edition. Pars. 64 and 125 seem to indicate clearly that *hydrargyrum* was not regarded as an adulterant, but as one of the materials on which *fraus* had been practised.

101. *stimmi*. Antimony. Dioscorides (5, 99) mentions all the names given by Pliny except *alabastrum*, which name, as suggested by Bostock and Riley, may have been due to the whiteness of the 'female' antimony. It seems likely that the 'male' variety was sulphide of antimony (stibnite), the 'female' being native metallic antimony, good specimens of which are bright and shining, and have a plate structure. The specific gravity of stibnite is 4.5-4.7, that of metallic antimony 6.6-6.8, the male variety being thus *minus ponderosus*. Dioscorides (loc. cit.) considers the shining kind superior, but does not use the terms 'male' and 'female'.

102. *platyophthalmon*. Big eyes were considered especially beautiful by the ancients. Hera was βοῶπις in Homer. There are several references in the Bible to painting the eyes (Kings 2, 9, 30; Ezek. 23, 40). In Jer. 4, 30, the R. V. reads, 'though thou enlargest thine eyes with paint, in vain dost thou make thyself fair'. This must be a reference to the use of antimony. Antimony does not dilate the eyes themselves, but contracts the eyelids. The darkening effect would also increase the apparent size of the eyes.

cummi. Added to make an ointment. This, rather than *gummi*, is read by the best mss. in H. N. 13, 66 and 32, 27 also.

adipi... et cera. These words surely include two alternatives. Each ointment is to contain antimony, lead (litharge or white lead) and a base (fat or wax). Litharge is still used in lead plasters. For *cerussa*, v. H. N. 34, 175f, and 35, 38f.

103. *Uritur ff.* Diosc. (5, 99) gives a similar account, but says that the ore was rolled in a lump of dough, covered with charcoal, and roasted till the dough was carbonised. If the ore was sulphide of antimony, the sulphur would be oxidised during this operation to sulphur dioxide and the antimony to antimonious oxide. The charcoal and the carbon formed from the cow-dung, or dough, as the case might be, would act as reducing agents, and some of the antimonious oxide would be reduced to metallic antimony which, sinking to the bottom during the decantation of the turbid liquid, would be rejected as *faex plumbosissima.* See note on *ne plumbum fiat* (par. 104).

et mundatur nitro. If the oxide of antimony contained some oxide of lead, the latter would be partly dissolved out by treatment with sodium carbonate. The reading of B, '*emundatum nitro*', may be correct, meaning that the copper vessel was scoured with soda.

linteo. Usually translated 'linen cloth', but it is clear from H. N. 12, 38 ff. that *linteum* is used of other kinds of cloth also.

104. *ne plumbum fiat.* Diosc. (5, 99) says ἐὰν γὰρ ἐπιπλέον καῇ, μολιβδοῦται. Hardouin considers that Pliny's expression is due to a misunderstanding of μολιβδοῦται, which, according to him, means '*plumbi instar liquescit*', as it is translated in the Latin version of Dioscorides. Stillman (History of Early Chemistry, p. 11.) like others, believes that excessive heating and reduction produced metallic antimony which was naturally mistaken for lead, and remarks that several articles of pure antimony have been found in excavations. This explanation is almost certainly correct.

adipe. Bostock and Riley consider this to be a mistaken translation of στέαρ in Dioscorides, which means, not 'fat', but 'dough'. Oribasius (13, s. v. *stibium*) says '*crematur stibium crusta ex farina circumlitum*'.

spongeave tollitur. This alternative to decantation is the exact equivalent of our modern method of pipetting a liquid.

effluxit. Mayhoff prefers the reading of the inferior mss., *defluxit.* This may be correct, but of the four passages, H. N. 33, 86, 99, 107; 34, 135, quoted in support, only 33, 99 provides a good parallel.

105. *helcysma.* Diosc. (5, 101) gives ἕλκυσμα and ἔγκαυμα as alternative names. The former appears to have been due to the viscosity of the slag in the case of silver, vouched for by the editor of the Desaint edition.

† *acre dies* † *additur.* B inserts *acre dies* which must be a corruption of something which is lost entirely in the other mss.. Some of Mayhoff's conjectures may be correct. Possibily the lost words belonged to the previous sentence, which may have concluded with *ægra est*, or to both sentences, *ægra. Et.*

liparas. No doubt, oleaginous plasters. Cf. H. N. 23, 162.

106. *Spuma argenti.* Cf. Diosc. 5, 102. 'Scum of silver' (called λιθάργυρος by Dioscorides) was undoubtedly lead monoxide (PbO). The variety of names mentioned in this paragraph and in par. 108 is due to the fact that the colour of lead monoxide or litharge depends on its method of preparation. When lead is melted, at a low temperature a dull grey coating is formed (possibly lead suboxide, Pb_2O). If this scum is removed and heated again in air without fusion, yellow PbO, sometimes called massicot, is formed. On fusion and cooling this yields a buff-coloured litharge, and if the cooling is very slow the litharge has a reddish tinge.

It is quite possible that the names *argyritis*, *chrysitis*, and *molybditis* were sometimes descriptive of colour and sometimes referred to the source of the lead monoxide, as Pliny evidently thought. It seems impossible to allot them definitely to the various kinds of lead monoxide now known. It is, however, interesting to note (with Blumner, Technologie 4, 155) that *Silberglätte* and *Goldglätte* are used in German, instead of *Bleiglätte*, for litharges of appropriate colours. The name *spuma argenti* is of course due to the fact that much of the silver of the ancients (as of the moderns) was derived from argentiferous galena or lead sulphide (cf. par. 95). Oribasius (13, s. v. *lythargyros*) says '*appellatur vero, quæ flavo colore est et splendet, chrysitis, quæ est etiam potior; livida vero, argyritis; quæ ex argento fit, calauritis*'.

tubulis. See note on *vericulis* (par. 107).

inde habet nomen. Nothing seems to be known about this name of *molybditis*, derived from Puteoli.

107. *Omnis autem fit.* For the ancient manufacture of litharge, see Agricola (De re met. 10, p. 384, Ed. Basil. 1561). The upper surface of the molten lead-containing mass was oxidised to litharge, and this upper layer was allowed to flow down into a lower vessel.

vericulis. Agricola (loc. cit.) has an illustration of a workman taking up some of the molten litharge on an iron spike and shaping it into a *tubulus*.

ut sit modici ponderis. The exact meaning is doubtful. Any unchanged lead would no doubt be oxidised to litharge by revolution in the flame. As the specific gravity of lead is 11.3, and that of litharge 9.36, the mass would certainly become less dense, though the total weight would be increased.

fervescentis et futuræ materiæ spuma. This I have translated 'scum from the boiling mass which is to provide the metal'. When a mixture of lead and silver is cupelled (i. e. oxidised) the lead can be entirely converted into litharge, and the silver left as a metal. This interpretation is supported by the following sentence. Mayhoff's conjecture, *e fusura*, is, nevertheless, tempting.

108. *molybdæna. Molybdæna* in H. N. 34, 173 is identified with *galena*, '*vena argenti plumbique communis*', which in this passage is probably native lead sulphide, though the word *galena* is used in a different sense in H. N. 34, 159.

ad magnitudinem anulorum. Diosc. (5, 102) says it was broken into pieces the size of a walnut. Sillig accordingly reads the old conjecture *abellanarum* (hazel-nuts), and Jan conjectures *nucularum*. Ajasson and the Desaint edition keep *anulorum*, but take it to mean that the pieces were small enough to pass through a ring. All this ingenuity seems unnecessary. A *tubulus* would naturally break into *anuli*.

ad separandos carbones cineremque. Impurities carried over with the litharge in the first operation would separate as a slag during the second fusion.

ut candor ei detur. The use of wheat, beans, crushed barley, and wool suggests analogy with the modern use of charcoal for removing impurities by adsorption.

donec ea purgentur. Cf. Diosc. 5, 102.

109. *cum desinant.* Mayhoff conjectures '*cum dies desinat*' to bring the phrase into line with Dioscorides' *εἰς ἑσπέραν*. But '*cum desinant calida*' when used in contrast with '*ter die... frigida*' gives this meaning without forcing, and the emendation is quite unnecessary. Possibly '*cum desinat*' (B) is right, *dies* being understood from the previous *ter die*.

addito sale fossili, in libram spumæ obolo. One function of the salt may have been to remove any silver oxide which, if present, would make the colour darker. Silver chloride would be formed and, dissolving in the excess sodium chloride, would be washed out. This was not, however, the sole, nor even the principal result of the operation, for pure litharge can be bleached by contact with sodium chloride, even in the cold. This is due to formation of basic chlorides, such as $5PbO, PbCl_2$, still made as "Cassel's yellow" by heating litharge with ammonium chloride, while on prolonged contact some $PbCl_2, PbO, H_2O$, a white pigment known in its pure form as "Pattinson's white lead", is formed. '*In libram spumæ obolo*' represents one part in five hundred and seventy-six, far too small a proportion to have been of much use. Dioscorides recommends several ratios, all giving much higher proportions of salt, so Pliny is probably mistaken.

nitro fricant. If litharge is rubbed with sodium carbonate or left in the cold in contact with a strong solution of sodium carbonate, it soon becomes markedly lighter in colour, a change due to partial conversion into carbonate of lead.

We see therefore that, by treatment with salt and soda, the Romans were able to obtain from litharge pigments of any shade from orange to palest yellow.

110. *Usus eius.* Litharge is still used occasionally in medicine. It is applied externally to allay inflammation, chiefly in the form of a plaster.

abluendum capillum. Lead preparations are still in use for darkening the hair, sometimes with disastrous results. It is probable that reference is here made to some such practice.

Another interpretation, at first sight possible, makes the words mean 'as a depilatory'. The editor has, however, applied a litharge plaster to his own skin without removing any of the hair as a result.

ignes sacros. Cf. Diosc. Parabilium 1, 168.

myrtisque et aceto. Hardouin preferred to read *myrtoque*, with d and h, in the sense of 'myrtle oil', prescribed by Celsus (5, 19, 26).

111. *minium.* It seems to be the general impression that ancient writers in general, and Pliny in particular, were unable to distinguish clearly the various red pigments from one another. A careful examination of par. 111-124 does not confirm this view.

Cinnabaris to Pliny meant 'dragon's blood' (see note on par. 116), and he condemns the popular error by which *minium* was styled *cinnabaris* (see note on par. 115), tracing the confusion correctly to the Greek word κιννάβαρι, which was used (e. g. by Dioscorides) to indicate mercuric sulphide.

The true *minium* was sulphide of mercury. Its vivid colour (117 and 121), its capacity for recovering its hue after heating (121, though a much clearer account is given by Vitr. 7, 9, 5), the destruction of the red colour by heating with lime (121), its conversion into the black modification under the action of light (122), and its use as a source of mercury (123), are all noted.

The *secundarium minium* (119-120) is red lead, probably prepared from cerussite (see note on par. 119), and Pliny seems to have recognized that the relation between red lead and lead was similar to that between iron rust and iron (see note on par. 121). No tendency to confusion with kermes (*coccum*) or the red ochres (*rubrica*, *sinopis*, etc.) is evident. The only unquestionable blunder is the reference to roasting *minium* (see note on par. 118). The supposed mistake in par. 123, of recommending preparation of mercury from red lead, disappears if, with Dalechamps, we take *ex secundario* adverbially. A second possible error is, however, to be found in the description of the precautionary measures taken against poisoning by *minium* (122). Dioscorides (5, 109) clearly indicates that these measures were taken by workmen engaged in the manufacture of red lead, a substance much more poisonous to those using it than is vermilion, but vermilion is also dangerous, and similar precautions may have been employed.

We must conclude that Pliny exhibits remarkably little confusion in dealing with what was for early scientists a very complex subject.

Verrius. Verrius Flaccus, a grammarian under Augustus and Tiberius, frequently quoted by Pliny (see on par. 63).

Iovis... faciem... minio inlini. The same fact is mentioned in H. N. 35, 157. Pausanias (7, 26) mentions the staining of the image of Dionysius with cinnabar (cf. Paus. 8, 39). Virgil (Ecl. 10, 27f) speaks of '*Pan... quem vidimus ipsi Sanguineis ebuli baccis minioque rubentem*'. Cf. also Cic. (Ad Fam. 9, 16, 8), '*polypum Miniati* (mss. *-ani*) *Iovis similem*'. Bostock and Riley remark with justice that this staining, intended to represent blood, was indicative of a very low state of civilisation.

sic Camillum triumphasse. In 394 B. C.

112. *expeti... Æthiopum populis, totosque eo tingui proceres.* In H. N. 6, 190, Pliny remarks that certain African tribes '*tota corpora rubrica inlinunt*'. Cf. also Herodotus 4, 194 and 7, 69.

113. *Praxibulum Atheniensium magistratum.* In Greek history, events were commonly dated by the name of the local official — the first archon at Athens, the first ephor at Sparta, etc. Theophrastus dates his events with respect to the archonship of Praxibulus (second year of 116th. Olympiad, i. e. 315 B. C.), because he was writing in that year.

urbis nostræ CCCXLVIIII annum. All mss. read *CCXLVIIII*, which seems clearly impossible. Casaubon, in his commentary on Theophrastus, suggested *CCCCXXXIX*, considering that the date referred to is that of the archonship of Praxibulus, a suggestion approved by Clinton (Fast. Hellen. 2, 321, Oxon., 1824) and adopted by Sillig. The old conjecture of Barbarus, *CCCXLVIIII* makes the date refer to the year in which minium was discovered. This seems more natural and involves a smaller change in the text. It hardly appears necessary to conclude with Casaubon that the error in this case was Pliny's.

114. *iam tum.* Hardouin made the conjecture *nativum*, in accordance with Theophr. Lap. 103, (Ed. Hill), where the adjective applied to the substance found in Iberia is αὐτοφυές. The conjecture is ingenious but seems unnecessary.

in Hispania. Cf. Dioscorides, 5, 109.

Cilbianis agris. Cf. H. N. 5, 120, and Vitruv. 7, 8.

harena. See note on par. 158.

cocci. The kermes is a red scale-insect common in ever-green oaks. The Encyclopaedia Britannica s. v., speaking of the gall-like female, says that 'it was not until 1714 that the animal nature was discovered'. It is clear, however, that the animal origin of the dye-stuff was known at a very much earlier date, for Isidore (Origg. 19, 28, 1) says '*κόκον Græci, nos rubrum seu vermiculum dicimus*', and the Hebrew *tholàath*, scarlet, (Leviticus 14, 4, and elsewhere) is translated in the Vulgate by *vermiculum*. The name kermes is probably connected with the Persian *qirmiz*, crimson.

The young insects, which are red and worm-like, are collected, dried, and made into a paste with vinegar. Until the sixteenth century, syrup of kermes was used as an astringent medicine.

lavari farinam et quod subsidat iterum lavari. Such methods of purification of powdered minerals by washing and decantation are in common use still.

dilutius. For this use, cf. H. N. 9, 138; 22, 92.

115. *rubrica.* Probably our ' red ochre ', a general term including many earths coloured by ferric oxide.

Homero teste qui naves ea commendat. Iliad, 2, 637.

Indicæ cinnabaris nomine. Sillig keeps *indicio nominum*, the reading of B, but a passage in Arrian (Per Mare Eryth. p. 159, Ed. Blancard) speaks of Indian cinnabar as an exudation from trees. The words which follow, ' *Sic enim appellant illi saniem draconis* ', make it certain that *Indico* or some equivalent word should be retained. The mistake in B may have been caused by a scribe who imagined that *Indicum*, when used of a pigment, always referred to *Indicum cæruleum* (cf. par. 163).

For Sillig's views, his lengthy note should be consulted.

116. *saniem draconis.* See H. N. 8, 32 for conflict between elephants and dragons; also H. N. 35, 50, ' *India conferente... draconum elephantorumque saniem* '. The ' dragon's blood ' of the ancients was probably like the modern article of that name, the resin of certain trees, notably' the *Pterocarpus draco.* It has been used in medicine as an astringent.

Hercules. This is the reading of B, all other mss. reading *Hercule.* Sillig notes that both formulae are employed by Pliny, and that we are therefore justified in adopting here the reading of the best ms.

venenum esse paulo mox docebimus. H. N. 33, 122 and 124.

117. *Cinnabari... monochromata.* This cinnabar is probably ' dragon's blood ', described in the previous paragraph. See also the adulterants mentioned below, which are more suitable for admixture with a resinous substance than with an inorganic pigment.

monochromata. Paintings in one colour.

Ephesio minio. v. par. 114.

curatio magni operis est. Probably a reference to change of colour (v. on par. 122), but the words may refer simply to difficulty of preparation.

rubricam et sinopidem. Cf. H. N. 34, 135; 35, 31-35. They were varieties of red ochre. Cf. Horace, Sat. 2, 7, 98, ' *prœlia rubrica picta, aut carbone* '.

sorbis. Service-berries or sorb-apples. The fruit of *Pyrus* (*Sorbus*) *domestica*, a tree which is a native of S. Europe and W. Asia. The berries are red-brown, bigger than those of the rowan. Like medlar-fruit, they are only eaten when in a state of incipient decay. Cf. H. N. 15, 85.

118. *Iuba.* Juba II, King of Mauretania, was educated at Rome and won a reputation by his historical works and works on the history of art. Pliny (H. N. 5, 16) says that he was '*studiorum claritate memorabilior etiam quam regno*'.

Carmania. North of the Indian Ocean, between Persia and Gedrosia.

Timagenes. There were several writers of this name, the most famous being the Alexandrian orator and historian, a friend of Asinius Pollio. Another Timagenes wrote a 'Periplus of the whole sea' in five books, and may well be the author here quoted. The name Timagenes does not occur in the list of Authorities for this Book, a fact which led Pintianus, perhaps correctly, to conjecture '*Timæus*' for '*Timagenes*'.

in Bætica miniario metallo. The quicksilver mines in Almaden in Andalusia have been worked right up to modern times.

excoquique. Mayhoff suggests that the true reading was *excoctaque*, which was corrupted, first into *excociaque* and then into *excoqui quæ*. This implies, however, that the first part of the refining was done in Spain, whereas Vitruvius (7, 9, 4) says that the clods (*glebæ*) were brought to Rome for treatment. In any case, Pliny is probably mistaken in mentioning roasting in connection with true minium (HgS), as he does again in par. 121., for mercuric sulphide would be thus oxidized and its colour destroyed. The correct treatment of the ore is indicated in par. 114, and the mention of roasting is no doubt due to confusion with the process for the manufacture of red lead.

dena. The addition to the *vectigalia populi Romani* represented by *bina milia* would be so small that *dena milia* seems preferable.

societati. A company of farmers of public revenues. Cf. Cic. Sext. 14, 32, id. Fam. 13, 9, 2.

119. *alterum genus.* This kind of minium was probably red lead (Pb_3O_4), manufactured from cerussite or native lead carbonate ($PbCO_3$). The latter, as described in this section, has often a colour not unlike that of lead. When roasted, it first loses carbon dioxide and leaves litharge (PbO), which on further roasting (oxidation) gives red lead. The red colour would, therefore, only be obtained after roasting. Cerussite is still found in Spain, and usually occurs associated with galena (argentiferous lead sulphide).

cuius vomicam argentum vivum. Cf. par. 99.

ipse in argentum vivum excoquitur. *Vivum* is found in no ms., but *argentum* by itself seems to make no sense. *Vivum* must be either understood from the previous line or inserted.

Steriles. I. e. of mercury.

120. *illas harenas.* V. par. 113 and 114, and note on par. 158.

sociorum. V. on par. 118.

Syricum. Cf. H. N. 35, 40, '*Syricum... fit... sinopide et sandyce mixtis.*'. *Sinopis* was an ochre. *Sandyx* was manufactured from *rubrica* (an ochre) and *sandaraca* (probably realgar, or red sulphide of arsenic, As_2S_2). For the latter, v. H. N. 34, 178.

minium compendii. The literal meaning of the word is adopted in the translation, though it has not been possible to find a parallel in later Latin. That the word originally meant a 'weighing together' is, however, clear from examples given by the Thesaurus Ling. Lat., e. g. Varro, L. L. 5, 183, '*compendium, quod cum compenditur una fit*'.

121. *cocci.* V. on par. 114.

secundarii... splendor... sentit robiginem. All mss. have *imaginem*, which does not appear to have any meaning. Sillig and Mayhoff read conjectures, *uliginem* and *plumbaginem* respectively. Though these at first sight make fairly good sense, neither fits in with the following clause, '*quamquam hoc robigo quædam metalli est*'. The editor, therefore, proposes *robiginem*, the *r* being rendered more probable by the fact that several mss. read *sentire* for *sentit.* Red lead darkens in use for two reasons. In presence of sulphuretted hydrogen, it gives the black lead sulphide, but even in absence of sources of this gas it gradually acquires a brownish hue, not unlike that of iron rust, due to the formation of lead dioxide (PbO_2). This process Pliny describes by the words *sentit robiginem.* The following clause suggests that Pliny recognised a similarity between the oxidation of lead to red lead and that of iron to ferric oxide. As both these changes can be produced by heating the metal in air, there is no reason why we should refuse to believe that the ancients were capable of this deduction.

harenæ. See note on par. 158.

excoquitur auri modo. As the *minium* of Sisapo was mercuric sulphide, this statement is mistaken. Cf. par. 118 and note on *minium*, par. 111.

auro candente. The gold is a support during heating, as is the iron mentioned a couple of lines later. We use platinum foil for similar purposes.

fucatum. V. par. 120.

sincerum retinet colorem. Vitruvius (7, 9, 5) gives a more accurate account, for he says that the *minium*, whether pure or adulterated, blackens on heating, but the pure regains its colour on cooling, while the impure remains black. This test would not distinguish between sulphide of mercury and red lead, both of which darken on heating and regain their colour when cold.

et calce adulterari. This adulterant is specially mentioned by Vitruvius (7, 9, 5). When heated strongly, a mixture of lime and cinnabar darkens permanently, mercury being set free in accordance with the equation, $4CaO + 4HgS = 4Hg + 3CaS + CaSO_4$ (v. J. W. Mellor — Comprehensive Treatise on Inorganic and Theoretical Chemistry (1923). Vol. IV, 955). It may be remarked that this test may be misleading in inexperienced hands. On *gentle* heating, the mixture of lime and cinnabar darkens, owing to change of the cinnabar into its black modification, but no chemical change takes place, and the colour is recovered on cooling.

122. *solis atque lunæ contactus inimicus.* A. H. Church notes that in water-colour painting most vermilions are changed on exposure to solar rays, even in absence of air and moisture. W. D. Bancroft adds that varnish on a picture cuts off ultra-violet light to a great extent and thus protects the picture (v. J. W. Mellor, op. cit. IV, 951). The action of the Punic wax and oil was no doubt similar.

Vitruvius (7, 9, 2.) is probably one of Pliny's authorities for his statements on this subject, though he is not included in the list of authorities for this Book, as he is for Books 16, 35 and 36. In a passage (loc. cit.) which clearly deals with mercuric sulphide (cf. Vitr. 7, 9, 1), he says that, though a *minium* paint is excellent in closed apartments, in open peristyles or *exedræ* it is spoiled by the light of sun and moon, and turns black. He tells how Faberius, a scribe, wishing to put an elegant finish on his house on the Aventine, applied *minium* to the peristyle. After thirty days it turned a mottled colour, so he contracted to have other colours applied instead.

Stillman (History of Early Chemistry, pp. 30-1) assumes that this *minium* was red lead, which is blackened rapidly by sulphuretted hydrogen, and says that mercuric sulphide is not blackened by exposure. The evidence cited above shows clearly that this view is incorrect, and we may also note that red lead would be as likely to be affected by sulphuretted hydrogen in closed apartments as in the open.

cera Punica cum oleo. This technique (v. also Vitr. 7, 9, 2) was doubtless suggested by the type of wax painting known as Encaustic. For an account of this see Laurie, Greek and Roman Painting. Cf. H. N. 35, 122, 149.

gallæ. It is suggested in the Desaint Edition that *galla* may have been a technical term for the unheated coat. No evidence on the subject is forthcoming, but the suggestion is tempting, for there seems no reason why charcoal made from such an unusual material as gall-nuts should have been used. Vitruvius (7, 9, 2) says that charcoal was heated in an iron vessel and held near the wall till the wax sweated.

sicut et marmora nitescunt. Cf. Juv. 10, 55 '*genua incerare deorum*'.

pernicialem pulverem. Continued breathing of either sulphide of mercury or red lead is injurious to the health. Dioscorides (5, 109) gives a similar account of the use of bladders, but speaks of the danger of poisoning as occurring in the mines.

ut per. Mayhoff, apparently finding difficulty in the idea of workmen seeing through semi-transparent bladders, conjectures *super.* In that case, one must understand *ut* from the preceding *ne*.

in voluminum... scriptura. Cf. Juv. 14, 192, '*leges rubras*'; also Petron. 46. The word 'rubric' is a reminiscence of this use which continued till the Middle Ages.

clariores. The comparative is used because the colour is 'brighter' than that possible without the use of minium.

123. *ex secundario.* These words are usually taken to mean that *hydrargyrum* is prepared from the *secundarium minium* (i. e. red lead. V. notes on par. 111 and 119). If this is so, Pliny has made a serious mistake, for not only was *hydrargyrum* prepared from the genuine *minium*, but this fact is made quite clear by Theophrastus (Lap. 105, Sir J. Hill's Edn.), mentioned by Pliny as one of his authorities for this book. The Desaint edition reads the words '*ex secundario*' after '*fecit*' at the end of par. 122, but the construction of the latter sentence becomes very awkward. The translation follows Dalechamps who took *ex secundario* to mean, 'as a secondary point'. Cf. use of *secundarium* in Cic. Inv. 2, 7, 24.

hydrargyrum. Cf. H. N. 33, 64, 100; Theophrast. Lap. 105 (Sir J. Hill's Edn.); Diosc. 5, 110.

Fit autem (et seq.). Sillig remarks that this passage is poor Latin.

trito minio ex aceto. The editor has repeated the experiment by grinding cinnabar (HgS) with vinegar and copper turnings.

In the cold the reaction is very slow indeed, but on heating it takes place readily enough, copper sulphide being formed, while the surface of the copper turnings becomes covered with a copper-mercury amalgam, from which the mercury may be driven off by heating. Pliny follows Theophrastus (loc. cit.).

patinis fictilibus impositum ferrea concha. Bostock and Riley and the Desaint edition imagine that the minium was placed in the earthen vessel, which was then enclosed in an iron one, the lid being luted on to the latter. This is clearly wrong, for Dioscorides (5, 110) states that an iron pan containing the cinnabar was set upon an earthen vessel.

We may also note that iron, being a more electropositive metal, would displace mercury from mercuric sulphide, thus assisting the preparation.

accensum... igni. 'Heated by fire'. Jan and Mayhoff apparently find it hard to accept this meaning of *accendo*, and read *accenso igni*, 'a fire having been kindled', with K.

The translation here given is, however, in accordance with Plinian usage. Cf. H. N. 2, 234, '*aquas... marinas... celerius accendi*'; 33, 94, '*calx aqua accenditur*'; 33, 65, '*æs... accensum restinguitur*'.

124. *venenum esse conveniat.* The reference is to *minium*, not to metallic mercury. Continued exposure to mercury vapour is harmful, but liquid mercury can be swallowed on occasions without evil result. Both sulphide of mercury and red lead are, however, poisonous.

125. *Hydrargyro argentum inauratur solum nunc.* Bostock and Riley translate incorrectly, " Silver is gilded almost exclusively by the agency of hydrargyros ".

eadem fraus. The using of white of egg instead of mercury (par. 100). The Desaint edition takes the substitute to be native quicksilver (white of egg being only used when the gold leaf was very thin). There is, however, no evidence that Pliny considered *argentum vivum* to be inferior to *hydrargyrum*, and if the reading *hydrargyro* in par. 100 (rejected in this edition) be retained, the inference is the other way round.

126. *coticulam*. According to Dana (Syst. Mineral.), a black flinty jasper, on which a streak is left by gold and alloys of gold. Theophrastus (Lap. 78-80, Sir J. Hills Edn.) says that those in use in his time were superior to the earlier touch-stones. His account also explains Pliny's rather cryptic remark about the side exposed to the sun, giving as reason that that side is drier, for the stone is one of those which sweat.

We have here an example of the way in which Pliny, faced with the necessity for being as brief as possible, renders obscure a story which was quite intelligible in his authority.

Tmolo. Mentioned H. N. 5, 111 and 118.

Heraclium. A name also given to the lodestone (H. N. 36, 127). The early editors considered that Pliny was mistaken in using it for the touchstone, but Theophrastus (Lap. 10, Ed. Hill) uses *λίθος Ἡράκλεια* of the touchstone.

a sole. For *a*, meaning ' on the side of ', cf. ' *ab Sequanis et Helvetiis* ' (Caes. B. G. 1, 1, 5), and ' *pleraque Alpium ab Italia... breviora* ' (Livy 21, 35, 11).

experimento ramentum. This brilliant conjecture by Dr. L. C. Purser, for the manuscript reading *experimentum*, removes the necessity for taking *experimentum* to mean ' sample ', an unparalleled meaning for the word.

scripulari differentia. Since the total amount thus analysed ' to the nearest scruple ' is not stated, we can hardly appraise the accuracy claimed here. It is unquestionable, however, that workmen used to employing them can often reach a high degree of accuracy by means of empirical tests.

127. *Argenti duæ differentiæ*. Bostock and Riley take the words to mean that there are *two kinds* of silver. The fact that two tests are mentioned in this paragraph makes the translation here adopted seem probable. There are two ways in which pure silver *differs from* impure silver.

nigro. Darkening indicates the presence of a more easily oxidised metal. Cf. the test for silver prescribed by the Leyden Papyrus X (Berthelot, op. cit. on par. 99, p. 39), which adds that silver which becomes black on heating contains lead, that which becomes yellow contains copper.

urina. The organic matter would act temporarily as a reducing agent, and thus prevent the oxidation which is responsible for the darkening.

sudet protinus nubemque discutiat. This property may be demonstrated by breathing simultaneously on pieces of polished silver and steel. Silver fogs more obviously and clears up more quickly. This is due to the better conductivity of the silver surface. The property is used in the construction of instruments for measuring the dewpoint.

128. *speciem fieri.* Examples of *species* with similar significations are to be found in Lewis and Short, s. v. *species*, C 1. The somewhat rare meaning caused corruption to the easier *specula*, but B retains *speciem*. For silver mirrors, cf. Plaut. Most. 1, 3, 107-112.

repercusso aere atque in oculos regesto. Bostock and Riley condemn this as a far-fetched explanation and one very wide of the mark. This is surely not the case. Pliny (or his authority) recognised the essential fact that, for the eye to perceive an image in a mirror, something must pass from the object to the mirror, be there reflected, and proceed to the eye. It was hardly possible at that date to imagine this something as a train of waves carried by the luminiferous ether, so it was pictured as a movement of the only medium then known to connect object, mirror, and eye — i. e. the air.

paulumque propulsa. To render it concave. A concave mirror gives a magnified, inverted, real image if the object is between the centre of curvature and the principal focus. If the object is nearer the mirror than the principal focus, the image is magnified, erect, and virtual.

respuat an excipiat. *Excipiat* clearly refers to a concave mirror, *respuat* to one that is plane or convex.

129. *monstrifica.* Cf. Seneca, Nat. Qu. 1, 5, where a description of distorting mirrors is given.

parmæ Thræcidicæ. Probably a reference to the shield of a *Thræx*, a gladiator armed with shield and short sword. Cf. Hor. Sat. 2, 6, 44; id. Ep. 1, 18, 36, and many other references.

transversa an obliqua. I take those difficult words to mean that either the whole mirror was oval or, possibly, the elevation or depression at the centre was oval, the oval having its major axis horizontal in some cases, and oblique in others. The words can hardly have any meaning in the case of a round mirror.

supina an infesta. A military metaphor clearly underlies these words, the flat mirror being like an enemy on his back, the upright mirror like one who is on his feet and threatening.

130. *digesta claritate materiæ... umbra.* Bostock and Riley took *digesta* to mean 'collected upon' the bright surface. The words '*in oculos regesto*' of par. 128 make this explanation improbable. *Digesta* probably refers to the 'arrangement' of the *umbra* into the final distorted form in which it meets the eye.

ut omnia... in hoc loco. Pliny, nevertheless, returns to the subject several times, e. g. 34, 160; 36, 196; 37, 97.

Brundisina. Cf. H. N. 34, 160.

stagno. V. note on par. 94. For mirrors of *stagnum*, cf. H. N. 34, 160.

Pasiteles. A worker in marble, ivory, bronze, and silver, who lived at Naples. He was also an author and wrote five books on famous works of art (H. N. 36, 39). Silver was probably a favourite material with Pasiteles, cf. Cic. Div. 1, 36, 79, '*hanc speciem Pasiteles cælavit argento*'. He never made a statue without first making a clay moulding (H. N. 35, 156). For further information, v. Jex-Blake and Sellers, 'The Elder Pliny's Chapters on the History of Art', p. lxxvii.

The reading *Praxiteles* is obviously incorrect, for that sculptor lived in the fourth century B. C.

auro opposito † *aversis* †. These words, retained by all editors, are clearly meaningless. To put gold on the back of a silver mirror would not improve its powers of reflection. This difficulty has long been realised and Dr. R. Watson (Chemical Essays IV, p. 246) considered that there must be some reference to glass backed with gold and quicksilver. He remarked that the Romans were in the habit of decorating their walls with plaques of glass, and that such a plaque on a dark wall is really a mirror. The Romans of Pliny's time could not then have been ignorant of the principles of glass mirrors.

The words in the text will not, of course, bear this interpretation which Beckmann (Hist. Inv. II, p. 72) therefore rejected. He says, 'I consider it more probable that some person had tried, by means of a polished plate of gold, to collect the rays of light and to throw them either on the mirror or the object in order to render the image brighter'. We may note that this interpretation also fails to give *aversis* any meaning.

Morin-Jean (note on *Vitrum* in Daremberg and Saglio) records that over five hundred little mirrors of glass backed with metal (usually lead) have been found throughout the Roman Empire, but most of them seem to date from the third century A. D. or later. A passage in H. N. 36, 193, however, makes it almost certain that glass mirrors had been made before the time of Pliny, for when speaking of the manufacture of glass he says, '*Sidone quondam his officinis nobili, siquidem etiam specula excogitaverat*'.

The required meaning is obtained if for *aversis* we conjecture *vitris*. This alteration, however, involves such a fundamental change of ideas that, although I believe it to be correct, I have not ventured to introduce it into the text. Dr. D'Arcy W. Thompson (private communication) suggests *vitris aversis*, which may well have been the original reading.

131. *Tinguit Ægyptus argentum.* De Paw took this to be a reference to the gilding of the face of Anubis which is sometimes found on silver dishes. This interpretation is rightly rejected by the Desaint edition. The " staining " was done with a kind of black, metallic varnish, the manufacture of which is described in this same section. An alloy of copper and silver blackened by the sulphides of these metals would be obtained.

The Leyden Papyrus X (Berthelot, op. cit. on par. 99, p. 37) describes the manufacture of a very similar material, an " asem black as obsidian ", by fusing together two parts of asem (usually an alloy of silver, copper, and tin, but sometimes made from other metals), four parts of lead, and three of sulphur.

Anubim. A dog-headed divinity, conductor of the dead, worshipped at Cynopolis.

coronarium. So called because used for making imitation gold crowns for use on the stage (H. N. 34, 94).

sulphuris vivi. Native sulphur (H. N. 35, 175).

132. *Nigrescit... luteo.* The yolk of an egg contains sulphur which darkens the silver by formation of a superficial film of silver sulphide.

aceto et creta. Chalk and vinegar form a cleaning material still employed for this purpose. Prepared chalk alone can be used as a plate-polish.

Mario Gratidiano. A friend of Cicero, brutally murdered by Catiline during the proscriptions of Sulla (Seneca, De Ira, 3, 18). Cicero (De off. 3, 20, 80) says, ' ... *cum prætor esset, collegiumque prætorum tribuni plebis adhibuissent ut res nummaria de communi sententia constitueretur. Iactabatur enim temporibus illis nummus sic ut nemo posset scire quid haberet* '.

133. *multiplicantur hæc.* I. e. *decies sestertium* is equivalent to *decies centena milia sestertium*, and so on.

Fænus hoc fecit ff. The necessity for numbers greater than 100,000 only arose with currency and usury.

Divites. The cognomen Dives is almost always found used of Crassi of the gens Licinia. It is however also used of L. Baebius Dives (Livy 37, 47, 8; 37, 50, 8) and L. Canuleius Dives (Livy 42, 28,5).

qui primus. Hardouin says that the first such person mentioned in literature is P. Licinius Crassus Dives, consul in 205 B. C., but admits that there is no evidence as to whether he is the subject of the present reference.

decoxisse creditoribus. The literal meaning of *decoquo* is ' to boil down '. From this it comes to mean ' to run through property ' and ' to become bankrupt '. Cf. Cic. Phil. 2, 18, ' *tenesne memoria, prætextatum te decoxisse ?* ' *Creditoribus* is *Dativus Incommodi.*

134. *M. Crassus.* Cf. Cic. Off. 2, 16, 57, ' *Crassus, cum cognomine dives* *tum copiis*'. For his epigram, cf. Cic. Paradoxa, 6, 1, and Plut. Crassus, 2.

reditu. Only found with this meaning in fairly late Latin. It is used somewhat similarly in H. N. 17, 8.

Parthorum. Crassus' Parthian expedition took place 54-53 B. C.

Callistum, Pallantem, Narcissum. These three freedmen were the chief clerks in the Imperial household, positions of such importance that they were practically ministers of state. Callistus, the '*a libellis*', was a freedman of Caligula. Pallas, '*a rationibus*', had been a slave of Antonia, mother of Claudius, and became paramour of Agrippina, wife of Claudius. He was poisoned by Nero in A. D. 63. Narcissus, '*ab epistolis*', brought about the downfall and death of Messalina in A. D. 49, and was put to death on the accession of Nero in A. D. 54. Callistus is mentioned again in H. N. 36, 60. For Pallas and Narcissus, v. Suet. Claud. 28. For all three, v. Tac. Annals, 11, 29, etc...

135. *tamquam adhuc rerum potiantur.* Pliny still remembered vividly the power of these tyrants and the danger of saying anything against them.

C. Asinio Gallo C. Marcio Censorino coss. 8 B. C.

C. l. This brilliant emendation for the manuscript *kl* seems almost certain. *Cæcilius* and *Claudius* were both gentile names, and it is most improbable that a single individual would have possessed them both.

136. *Ptolemæi.* Apparently Ptolemy XI (Auletes), who ruled 80-51 B. C.

Varro. M. Terentius Varro (116-27 B. C.) was a most prolific writer. In addition to his extant treatises on grammar and agriculture, he was the author of the *Disciplinæ*, the earliest encyclopædia of the liberal arts, the *Imagines*, a series of illustrated biographies, the *Antiquitates*, a work on Roman history, the *Saturæ Menippeæ*, and other works.

Pompeio res gerente circa Iudæam. 63 B. C.

137. *Pythii Bithyni.* According to Herodotus (7, 27) and other authorities, Pythius was a Lydian who derived his wealth from gold mines near Celaenae in Phrygia. Instead of acceding to his modest request, Xerxes put his eldest son to death, cut his body in half, and marched his army between the portions. The four other sons were all slain in battle.

The name is variously given as Πύθιος and Πύθης (v. note in Wessel and Valcken's Herodotus on loc. cit.).

plătanum auream vitemque. Cf. par. 51.

138. *Sp. Postumio Q. Marcio coss.* B. C. 186.

Tanta... L. Scipioni. Cf. Livy, 39, 22, 8. In Livy 25, 12, 14, we have an account of an earlier contribution. '*Ludos prætor in circo maximo cum facturus esset, edixit ut populus per eos ludos stipem Apol-*

lini, quantum commodum esset, conferret'. This however was a *compulsory*, not a *voluntary*, contribution. For L. Scipio Asiaticus, cf. par. 148.

Agrippæ Menenio. On the occasion of the first secession of the plebs (494 B. C.) he related the fable of the "belly and the members" (Livy 2, 32; Val. Max. 4, 4, 2). For his death and the contribution of *sextantes*, v. Livy 2, 33.

139. *Gratiana*. cf. Mart. 4, 39, 6, '*nec desunt tibi vera Gratiana*'. The other makes do not seem to be elsewhere mentioned.

anaglypta. cf. Mart. 4, 39, 8.

linearum picturas. There may have been figures actually painted on the silver, although the Desaint edition takes *picturas* metaphorically.

140. *mensas repositoriis imponimus*. The explanation offered by Sillig after a study of Petronius, Sat., 35 and 36, is probably correct. Petr. (Sat. 36) tells how four attendants removed the upper part of the *repositorium*, disclosing a lower shelf of delicacies. The *repositorium* was evidently a sort of side-board or dumb-waiter with an upper shelf (*mensa*) which could be removed at will.

A real difficulty, ignored by Sillig, is that of understanding why *mensæ* and *repositoria* are introduced into the middle of a section dealing with silver plate, without any mention of silver adornment. Presumably either the *mensæ* or the *repositoria* or both were decorated with silver (cf. par. 146) and some words may have fallen out.

interradimus alia. Cf. *interrasili auro*, H. N. 12, 94.

Calvus orator. C. Licinius Calvus, born in 82 B. C., was son of C. Licinius Macer, a prætorian who was impeached for extortion by Cicero in 66 B. C. and committed suicide.

Calvus died when about thirty-five years of age. There are many references in Cicero, Quintilian, and other writers to his elaborate speeches.

quiritat. '*Quiritare dicitur is, qui Quiritum fidem clamans implorat*', Varro, L. L. 6, 68.

carruchas. Cf. Mart. 3, 47, 13 and other passages (v. Hardouin's note). This is the earliest mention of *carruchæ*.

soleas... iumentis... ex auro... induere. Cf. Dio Cass. 62, 28.

141. *Triginta duo libras*. Sillig suggests that *duo* for *duas* is a quotation from the legal Latin of Africanus' will. According to Plutarch the amount was thirty-three pounds of silver and two of gold.

de Pœnis triumpharet. B. C. 146.

Numantia quidem deleta. B. C. 133. The triumph took place in the following year.

Frater eius Allobrogicus. The reference must be to Q. Fabius Maximus Allobrogicus, consul in 121 B. C., son of Q. Fabius Maximus Aemilianus who was son of Aemilius Paulus and brother of the younger Africanus.

Allobrogicus was, therefore, nephew of Africanus, and is here confounded by Pliny with his father.

142. *propter quinque pondo notatum... senem.* The *senex* was P. Cornelius Rufinus, expelled from the senate (according to Gellius, 4, 8 and 17, 21) by the censors C. Fabricius Luscinus and Q. Aemilius Papus, for possessing *ten* pounds of silver, although he had been twice consul and also dictator. Cf. also Val. Max. 2, 9, 4 and Livy, Epit. 14, where ten is the figure given. *quinque* is clearly a mistake. The law allowed the possession of *not more than* five pounds of silver.

Catum Ælium. Q. Aelius Tubero Catus. Cf. Val. Max. 4, 3, 7. Merula ad Enn., p. 505, assumes that both Pliny and Valerius Maximus are wrong, and that this was Q. Aelius Paetus Catus, but he gives no proof of his assertion.

duo pocula. Cf. Val. Max. 4, 4, 9 and Plut., Aem. Paul. 28.

L. Paulus. L. Aemilius Paulus defeated Perseus, king of Macedonia, at Pydna in 168 B. C.

143. *Invenimus legatos ff.* The praise of the Carthaginians was, of course, mocking.

Hercules. Cf. note on par. 116.

Arelatensis. This town, termed *Gallula Roma* by Ausonius (Clar. Urb. 7, 2), was variously called Arelate, Arelatum and Arelas. It was a Roman colony on the Rhone — the modern Arles.

paternaque gente pellitum. The meaning of these words is obscure. Philemon Holland took *pellitum* to be an archaic participle from *pello*. Hardouin, however, considered it to be a title of honour, referring to the dress of the local assembly (' graced with the fur ' — Bostock and Riley), and quotes Claudian (26, i. e. de Bell. Goth., 481), ' *Crinigeri sedere patres, pellita Getarum Curia* '. But this was surely no title of honour, but a description of the humble dress of the Getic fathers. The same is true of the other passages quoted by Hardouin. O. M. Dalton (Letters of Sidonius, Introd. cix : cf. xxxiii, note) says, " The skin garment is the great characteristic of the barbarian in the Roman's eyes; the adjective ' *pellitus* ' is used almost as a synonym for ' barbarian ' ". Cf. ' *pellitos Sardos* ', Livy, 23, 40, 3.

Pliny probably meant to point the contrast between the wealth of Paulinus, whose line was soon lost in obscurity, and the poverty of the Roman patricians who had to borrow one another's silver.

144. *triclinia.* Banqueting-couches, running round three sides of a table.

Carvilius Pollio. Cf. H. N. 9, 39.

Deliaca specie. Cicero mentions *vasa Deliaca* (Rosc. Am. 46, 133) and *supellectilem Deliacam* (Verr. 2, 2, 34, 83 and 72, 176). These articles may have been made from the famous *æs Deliacum* (H. N. 34, 8-9).

Punicana. These couches appear to have been inferior. Seneca (Ep. 96, 72) says they were *ligneos*, and Isidore (20, 11, 3) calls them *parvi et humiles* (*lectuli*). Cf. also Cic. Mur. 36, 75 and Val. Max. 7, 5, 1. The point of the present passage is not clear. Perhaps a silver couch which followed the Delian fashion would be of solid silver, as its model was of solid bronze, while the Punic one would be merely ornamented here and there with silver.

bellum Sullanum. 83-82 B. C.

145. *comites*. For similar uses, cf. H. N. 14, 15, '*ut prægrandibus* (*uvis*) *adhæreant parvi comites*'; H. N. 37, 55, '*adamas..., comes auri*'; Mart. 7, 53, 4, '*his comes accessit spongia*'.

conservi. Note the bitter irony.

146. *Cornelius Nepos*. Lived 99-24 B. C. The poems of Catullus are dedicated to him. His extant work is biographical (*De viris illustribus*).

duo tantum. Doubtless those mentioned in par. 144. The reference is not found in the extant work of Nepos.

repositoriis. V. note on par. 140.

Fenestella. L. Fenestella, a Roman historian who died in 21 A. D. in the seventieth year of his age. He wrote *Annales* extending to at least twenty-two books, which are frequently quoted by Pliny, Aulus Gellius, Asconius, and others.

testudinea ff. Ajasson takes the rest of the section to refer to *triclinia*. This is clearly wrong, and most editors are agreed that the references are to *repositoria*. For tortoise-shell decorations, cf. H. N. 9, 39.

lignea, *rotunda*, *solida*. The earlier *repositoria* were doubtless simply sections of the trunks of big trees.

tympana. From the round shape of many of these articles.

a stateris et lances. *Lanx* was a common word for the pan of a balance, cf. Virg. Aen. 12, 725, etc...

magides. Pollux (6, 12) says that μάγις was used of a table, a meaning closely allied to that in the present passage. The word had several significations, e. g. it meant a kneading-trough (κάρδοπος), according to Suidas (See Constant. Lex. s.v. μάγις). *Magida*, read by V and W in the present passage, was apparently quite a different word. Varro (L. L. 4) says it was a dish, so called from *magnitudo*.

147. *Delphinos*. Probably some kind of vessel for table use. One could easily devise dishes, vases, sauce-boats, etc. shaped like dolphins with hollow backs. Hardouin quotes Plutarch (Gracch. 2, p. 825) that Gracchus bought silver dolphins for 1250 denarii a lb.

Lucius Crassus orator. L. Licinius Crassus, born in 140 B. C. He successfully impeached C. Carbo for the murder of citizens without trial when only twenty-one, and had a distinguished political career, dying in 91 B. C.. He is introduced as one of the principal speakers in the " *De Oratore* " of Cicero.

Mentoris. Little detail is known of the life of this *cælator*, although there are many references to his work. Pliny tells us that he made four pairs of cups which perished in the burnings of the temple of Diana at Ephesus and that of Capitoline Jove (cf. H. N. 7, 127 and 33, 154).

148. *Asia ...devicta.* At Magnesia in 190 B. C. It is interesting to note how Pliny traces the Roman taste for art treasures to this series of victories, etc. Such sudden influxes of artistic objects into less cultured lands have hardly any parallel in modern times.

Lucius Scipio in triumpho. 189 B. C.

anno... DLXV. Sillig rejects the date, which is given by all mss. except B, as being here out of place. It seems to the editor quite as much in place as the dates of the following paragraph.

Asia donata. Left to Rome in 133 B. C. by the will of Attalus III, last king of Pergamum.

149. *Achaicæ victoriæ.* The capture of Corinth by Mummius in 146 B. C.

in hoc intervallo. For examples of *in* with the ablative of time in Pliny, see Sillig's note on this passage.

150. *Carthago sublata.* 146 B. C., i. e. in the same year as the *Achaica victoria* just referred to.

C. Marius post victoriam Cimbricam cantharis potasse. Marius' victory over the Cimbri was in 101 B. C.. Valerius Maximus (3, 6, 6) also tells us that Marius always drank from a *cantharus* because Bacchus had done the same, ' *ut inter ipsum haustum vini victoriæ eius suas victorias compararet* '. Brotier thinks that a compliment to Marius is intended, inasmuch as he drank, not from one of Mentor's cups, but from an ordinary tankard, like the wine-god himself. The whole tone of the passage (and of that from Valerius Maximus), and the final jibe at the ' *manipularis imperator* ' are against this interpretation. The words were surely meant as a reproach to Marius for having thought himself a peer of Bacchus. The connection with the preceding sentences is a little vague.

Arpinas. Marius was born at Cereatæ, near Arpinum.

151. *statuas... divi Augusti.* For these silver statues, cf. Suet. Oct. 52.

Pharnacis qui primus regnavit in Ponto. These words must mean, " Pharnaces the first, king of Pontus ", though they would more naturally signify " Pharnaces, the first king of Pontus ". Pharnaces however was not the first king of Pontus, a fact of which Pliny could not possibly have been ignorant. He was the son of Mithridates IV and came to the throne about 190 B. C. (Clinton, Fast. Hell. III, pp. 424-5).

Mithridatis Eupatoris. Mithridates VI, commonly called ' the Great '.

He came to the throne in 120 B. C., and committed suicide in 63 B. C. after his final defeat by Pompey.

According to Appian (Mith. 116), a gold statue of Mithridates, eight cubits high, was carried in triumph by Pompey.

compedes. Cf. par. 40.

152. *Arellium Fuscum*. Not *Fuscus marmorea meditatus prœlia villa* (Juv. 4, 112), who was killed in the Dacian War, but Arellius Fuscus, a rhetorician of the reign of Augustus, who numbered Ovid among his pupils. Cf. Seneca, Contr., Bk. I.

capuli... cælentur argento. Dalechamps remarks that this custom was at least as old as Homer. V. Iliad 2, 45.

pædagogia... custodiantur argento. See Celsus 7, 25, 3.

solia. *Solium* was properly the seat over the bath, but the word was often used for the bath itself. Cf. Lucr. 6, 800, '*solio ferventis aquai*'; Celsus 7, 26, 5, '*in solium aquæ calidæ*'; Petron. Sat. 92, '*circa solium sedentibus*', where the *solium* is a *piscina*.

153. *Fabricius*. C. Fabricius Luscinus, who fought against Pyrrhus,, and who, as censor, censured Rufinus for the possession of more than the legal amount of silver (v. par. 142 and note). Pliny quotes him, with Curius, (H. N. 9, 118) as having enjoyed a modest triumph.

pateram et salinum habere ex argento. Cf. Val. Max. 4, 4, 3.

157. *Argentum medicatis aquis inficitur*. The sulphur contained by many medicinal waters would be one of the principal factors in tarnishing the silver by the formation of silver sulphide.

afflatu salso. This tarnishing, familiar to all who live near the sea, is due to reaction between the silver and the film of sodium chloride solution formed on the surface. Silver chloride is formed and subsequently decomposed by the action of light. Black, finely-divided silver is deposited.

sic et. This emendation from the Desaint edition gives a sense so much superior to that of the manuscript reading, *sicut*, that I have introduced it into the text.

158. *sil*. One of the four colours used by Apelles and other painters (H. N. 35, 50). *Sil* is best translated by 'ochre', and included many naturally occurring oxides and hydroxides of iron. It was an ingredient of '*leucophorum*' (par. 64 and 35, 36), and the 'marbled' variety was burnt to give '*cerussa usta*' (H. N. 35, 38).

cæruleum. See on par. 161.

limus est. Yellow ochres are often very soft. Theophrastus (Lap. 71, Sir. J. Hill's Edn.) speaks of 'earths', such as μίλτος (*rubrica*) and ὤχρα (*ochra*), and 'sands', such as χρυσοκόλλα (*chrysocolla*) and κυανός (*cæruleum*). *Limus* and *harena* seem to have been almost technical terms for soft and hard pigments. For *harena* thus used see pars. 113, 114, 120 and 161. Cf. also Dioscorides 5, 108. Thompson (Chemistry of the Ancient Assyrians, sects. 2 and 29) points out that *abnu* (Assyrian for ‘ stone ’) covers many inorganic substances.

optimum... Atticum. Vitruvius also (7, 7, 1) considered the Attic ochre the best. Cf. also H. N. 35, 50.

marmorosum. The variety said, in the following section, to be least injured by lime. It may have been a hard haematite. The different degrees of resistance to lime were doubtless due to variations in the resistance of the ochre to dehydration.

pressum. This word is translated ‘ compressed ’ by Bostock and Riley, but it more probably means ‘ dark ’, the meaning adopted by Hardouin. Pliny (H. N. 5, 32) says of *sinopis*, ‘ *eius quæ pressior vocatur et est maxime fusca* ’. Palladius (4, 13) gives *pressus* in his list of adjectives denoting shades of colour, and Servius (on Virg. G. 3, 82) says ‘ *Spadices — quos vocant pressos* ’. The words from the following paragraph, ‘ *quo utuntur ad picturæ umbras* ’, agree with this view.

159. *iam et.* Sillig quotes parallels to show that *iam et* in Pliny is equivalent to *porro etiam.*

abacos. For *abacus* in this sense, see Vitr. 7, 3, 10. Cf. H. N. 35, 3 and 32.

marmor... resistit amaritudini calcis. Cf. note on *marmorosum* (par. 158). Painting directly on to wet lime was not uncommon (v. Laurie, Greek and Roman Painting, p. 70). Pliny (H. N. 35, 49) gives a list of pigments which ‘ *cretulam amant udoque inlini recusant* ’, where *udo* probably refers to a wet lime surface. *Amaritudini* is doubtless really equivalent in this case to our alkalinity.

160. *Postea uritur.* Ochres darken on heating, owing to conversion of ferric hydroxide into ferric oxide by loss of water. Hence the resulting ochre was *pressum.*

Polygnotus. A Thasian by birth, he came to Athens in the time of Cimon. He executed many famous wall-paintings and was praised by Aristotle and others for his mastery in the expression of character. Cf. H. N. 35, 42, 58-9, 122-3.

Micon. One of the most famous contemporaries of Polygnotus. Like the latter, he assisted in the decoration of the famous Stoa Poecile at Athens. Cf. H. N. 35, 42, 59.

161. *Cæruleum.* Several different substances probably received this name. Vitruvius (7, 11, 1) describes a blue glass, made at Alexandria, and later at Puteoli, by grinding together sand and soda, grating copper over it, rolling the mixture into balls and heating in a furnace. Such a blue glass was found at the baths of Titus, analysed by Sir Humphrey Davy, and experimentally reproduced by him (Stillman — History of Early Chemistry, p. 34). The *Puteolanum* described by Pliny may have been of this nature, but it is clear that some of the varieties here mentioned occurred naturally.

Theophrastus (Lap. 70, Sir J. Hill's Edn.) speaks of native κυανός, which contains chrysocolla, and Dioscorides (5, 106) says that κυανός is found in copper mines. As lapis lazuli could hardly have been common enough to be sold at the moderate prices quoted, this pigment must have been azurite, one of the basic copper carbonates ($2CuCO_3.Cu(OH)_2$), and the passage from Theophrastus suggests that its kinship to *chrysocolla* or malachite ($CuCO_3.Cu(OH)_2$) was recognised. Malachite and azurite often occur together, and stalactitic forms have been found, consisting of an axis of malachite surrounded by a layer of azurite.

Some Egyptian glasses have been found which contained cobalt, but Beckmann (Hist. Inv. 1, 472) is doubtless right in considering that *cæruleum* was a copper blue rather than a cobalt blue.

For lapis lazuli as a pigment of the Ancient Assyrians, v. Thompson, Chemistry of the Ancient Assyrians, sect. 32.

in quattuor colores mutatur. Sillig compares with a similar passage in Theophrastus (De Lap. 100, Sir J. Hill's Edn.).

in sua coquitur herba. The early editors were misled, by the reference to *Indicum* in par. 163, into thinking that the *herba* here mentioned is the *Indigofera tinctoria* or indigo-plant. This is clearly wrong. Pliny (par. 91) says '*Luteam putant a luto herba dictam, quam ipsam cæruleo subtritam pro chrysocolla inducunt*', and Vitruvius (7, 14, 1), '*qui non possunt chrysocolla propter caritatem uti, herba, quæ lutea appellatur, cæruleum inficiunt, et utuntur viridissimo colore*'.

The *herba* was therefore *reseda luteola* (weld), and the dyeing process was probably entirely analogous to that described in the note on *chrysocolla* (par. 86).

162. *Ex cæruleo... lomentum.* Cf. preparation of a similar *lomentum* from *orobitis* (par. 89).

calcis impatiens. The colour of the *cæruleum* or *lomentum* would be injured by lime, the calcium of the lime displacing copper, with the formation of white calcium carbonate.

Vestorianum. The factory of Vestorius was at Puteoli (Vitruv. 7, 11, 1). He may have been the Vestorius mentioned in Cicero's letters (Att. 4, 13, 16; 6, 2).

X XI in libras. Most of the mss. read simply *XI*, which many editors have changed into X I. This cannot be correct. Egyptian *cæruleum* seems to have cost eight denarii a pound. The Vestorian was made from the finest part of it and must, therefore, have been dearer. Even if *levissima* could be taken to mean 'the least valuable' part of the *cæruleum*, the price could hardly have been reduced to one-eighth.

ad fenestras. The exact meaning of these words is doubtful. They may refer to the painting of the walls or woodwork round the window, or may simply mean, as Beckmann thinks, that this variety was used *near* windows, as being more stable to light.

163. *Indicum* i. e. *Indicum cæruleum*, as is clear from the second part of the paragraph. It had, nevertheless, no kinship with ordinary *cæruleum*, and was unquestionably indigo. Cf. H. N. 35, 46, and Diosc. 5, 107. We may notice that the Romans do not seem to have used indigo as a dye, although the Egyptians employed it for mummy-shrouds, and the Hindus were acquainted with its possibilities (Thorpe and Ingold, 'Vat Dyes', chap. 3). This is certainly due to the fact that the Romans knew no way of reducing the insoluble indigo-blue to the soluble indigo-white. The dye is taken up by the fibres in this soluble form, and then oxidized by the air to the insoluble indigo-blue.

incisuras. Cf. *commissuras*, H. N. 35, 29.

Cærulei sinceri experimentum in carbone ut flagret. Cf. H. N. 35, 46, where a fuller account is given of this flame-test. The indigo volatilises; and is eventually consumed, being a non-metallic organic compound. Counterfeit *Indicum* such as that subsequently described, or *Indicum* adulterated with such fillers as gypsum, chalk, etc., would be thus detected. The test was, of course, one for *Indicum cæruleum*, and not for *cæruleum* in general.

viola. Usually translated 'violet'. The word seems, however, to have been used to describe several flowers. Vitruvius (7, 14, 1) gives what seems to be the same method for preparing an imitation Attic *sil*, but the flowers can hardly have been the same in both cases. Pliny (H. N. 21, 27, cf. 21, 130-1) says '*violis plura genera*, *purpureæ*, *luteæ*, *albæ*', and we may suppose that the *purpureæ* were used for imitation *cæruleum* and the *luteæ* for imitation *sil*. It was, no doubt, to the *luteæ*, or *albæ* that Horace referred in his famous '*tinctus viola pallor amantium*' (Odes 3, 10, 14).

causticis. The principal ingredients in *caustica* were usually organic (H. N. 25, 173; 26, 3, 65), but arsenic was also used (H. N. 34, 178).

teritur autem difficillime. In Sillig's and earlier editions, these words are connected with the following '*sil*'. As however *sil* was a *limus* and *cæruleum* a *harena*, the words, as Mayhoff recognized, are obviously more applicable to the latter.

164. *Sil in medendo ff*. Similar uses for ochre are given by Dioscorides (5, 108), and Celsus (5, 14) says '*carnem alit et ulcus implet... ochra Attica*'.

annonam flagellat. The exact sense of *flagellat* is uncertain, though the general meaning is not doubtful. It may mean that the merchant 'whips together' the whole of the corn, a signification probably present in '*laxas arca flagellat opes*' (Mart. 2, 30, 4), or it may simply mean that he ‘ scourges ’ the market, for which cf. Persius 4, 49, ‘ *si puteal multa cautus vibice flagellas* ’.

Seplasia. A street in Capua, where unguents and pigments were sold. Cf. H. N. 16, 40 and 34, 108.

auctoritas. The editor has been unable to find an exact parallel to this use.

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